Order Number 9111607

# An examination of formal and informal professional-growth activities of teacher members of the Michigan Science Teachers Association

Hyduke, Robert Allan, Ph.D.

Michigan State University, 1990

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

# AN EXAMINATION OF FORMAL AND INFORMAL PROFESSIONAL-GROWTH ACTIVITIES OF TEACHER MEMBERS OF THE MICHIGAN SCIENCE TEACHERS ASSOCIATION

By

Robert Allan Hyduke

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Teacher Education

1990

Abstract

AN EXAMINATION OF FORMAL AND INFORMAL PROFESSIONAL-GROWTH ACTIVITIES OF TEACHER MEMBERS OF THE MICHIGAN SCIENCE TEACHERS ASSOCIATION

By

Robert Allan Hyduke

The Problem

At present there is a lack of information concerning formal and informal professional-growth activities of practicing science teachers in grades kindergarten through high school.

It was the purpose of this study to identify and examine the level of formal and informal professional-growth activities of a selected group of science teachers as these are conducted in practice and to examine the nature of changes in the way knowledge is acquired during one's career.

Method

A survey instrument was sent to 2287 Michigan Science Teachers Association members and a response rate of 50.5 percent, was attained.

From the total number of responses only those which were from fulltime kindergarten through twelfth grade teaching staff were selected for analysis. Initial analysis used an averaging method to examine professional-growth activity. Further analyses used the Chi-Square test or the Analysis of Variance test.

Findings

An analysis of the data suggest that there is a decrease in formal professional-growth activity of science teachers as they mature. In contrast, the level of informal professional-growth activity of science teachers appears to remain constant or to increase relative to the beginning of a science teachers' career.

An examination of the decrease in formal professional-growth activity suggests that it may be more the result of the maturing science teacher electing not to take graduate college credits rather than a decline in all types of formal professional-growth activity. Attendance at professional conferences and participation in after-school inservices did not show a significant decline.

To

Edward P. Hyduke Sr. and Mary (Sofian) Hyduke

## ACKNOWLEDGEMENTS

I wish to acknowledge and thank a number of individuals who assisted me in completing this study. I am grateful for the assistance of my committee members Charles Blackman, Bruce Cheney, Arden Moon, and John Suehr. While all the members of my committee were helpful it was Charles Blackman who provided a blend of editorial expertise and friendship which helped focus my efforts. Special thanks to the Michigan Science Teachers Association Board who allowed me to contact their membership and contributed to the development of the questionnaire, Cynthia Addison who was my contact with the organization, and those individuals of the organization who responded to the questionnaire.

Finally, I wish to thank my wife Barbara, my children, Becky, Daniel, Sarah, Abigail, Emily, and Kathleen for the love and understanding each contributed while I worked on this study.

TABLE OF CONTENTS

## LIST OF TABLES

# CHAPTER I

## INTRODUCTION TO THE PROBLEM

### The Context of the Problem

In April of 1983 the United States Government released a report concerned with the state of the Nation's public educational system. That report, A Nation at Risk: The Imperative for Educational Reform (National Commission on Excellence, 1983), suggested that the economic and democratic state of the nation is closely tied to the educational health of the nation. It also suggested that our present educational system had lost sight of its purposes and high expectations and that as a result both the economy and the high ideals of our nation were at risk.

As a basis of their evaluation A Nation at Risk used: 1) curriculum content, 2) student expectations and achievement, 3) student time on task, and 4) teacher characteristics. In every area evaluated the commission found justification for concern and presented recommendations to rectify those conditions.

Because of the widespread dissemination of the findings and recommendations of A Nation at Risk education once again became a newsworthy topic of discussion. The intensity of the public's concern and that of those involved in education itself was echoed in the vast amount of literature which followed (Cross, 1984).

In A Place Called School, Goodlad (1983), explored the concept of the "Common School" and suggests that there are indeed concerns with what is expected of schools today, how schools function, and how the schools themselves are evaluated. He concludes that much of what the public appears to desire, "back to basics", exists within the schools, but that what the public expects of its schools cannot occur unless there is major restructuring of schools in light of educational research and community interaction and cooperation.

Some of the changes suggested by Goodlad's evaluation are: earlier enrollment and graduation to match an individual's stage of learning; a clearly defined set of goals and evaluative measures which includes academics for all students; improving the conditions of teaching and the teacher's knowledge and skills; and the acceptance of an ecological perspective

of education which cooperatively moves education back into the community at appropriate stages.

In High School, Boyer (1983), suggests that from a historical perspective high schools have been successful; however, today's high schools appear to have lost their direction in light of changes in society and the demands placed upon them.

To bring the high school back on course Boyer suggests a direction which would refocus the goals of the high school in relation to its place and purpose in the local and global society. He would add more substance and global perspective to the core of schooling; improve the instructional delivery system through flexible scheduling; provide for better initial teacher education and renewal and reunite the schools to colleges, businesses and their communities.

Of particular interest to this research project are those findings which relate to the classroom teacher's initial preparation and continuing education which have been used to justify and legislate new standards for future teachers.

A Nation at Risk recommends that each future teacher should demonstrate an aptitude for teaching and competence in an academic discipline. Goodlad

recommends a program which would provide for extensive clinical experience under guidance. Boyer proposes selective recruitment, strong preparation in a core curriculum and academic discipline, and a fifth year of apprenticeship.

In apparent response to the calls for improved teacher preparation, a National Board for Professional Teaching Standards has been formed (Linn, 1987). The National Science Teachers Association has developed a voluntary certification program which identifies minimal subject-matter backgrounds for its membership. And the Michigan Department of Education, State Board of Education has adopted Rule 35 which pertains to continuing education for teachers in section R 390.1135 of the Michigan Teacher Certification Code. The rule was originally intended to take effect on or after September 1, 1989 (Michigan Science Teachers Association, 1988). However, its implementation has been postponed until after June 30, 1992 (Michigan Teacher Certification Code, 1989). The intent of Rule 35 is to require each teacher who is granted a certificate to teach in Michigan by the State Board of Education to complete successfully a minimum of six semester hours of approved academic or approved

equivalent continuing education units within five years of the granting of the professional certificate.

A problem of timely implementation arises, however, when one considers that any changes in standards for teachers will have little effect upon the present educational system until all of the present teachers have been replaced, have participated in inservice activities equivalent to those standards, or have independently accepted the need for and participated in professional-growth activities equivalent to the new standards.

A survey conducted by the Michigan State Board of Education "1987 Report on Survey of Michigan School Staff Eligible to Retire," (Michigan State Board of Education, 1987) states that the average retirement rate per year for teachers in that survey is 6.7 percent. That is, 6.7 percent of the teaching force will retire each year.

The 1987 survey found that the average experience for male teachers and female teachers in the population from which the sample was drawn was 16 years and 14 years respectively. The average age of male teachers was 44 and that of female teachers was 43.

The report cautions that the number of retirements will not necessarily indicate a teacher shortage because of enrollments in teacher preparation programs, a pool of certified people who were not able to get jobs, the re-entry of certified people into teaching, outstate teacher applicants, and other professionals who have expressed a desire for a mid-life career change to teaching.

The net effect of changes in initial teacher preparation and certification requirements, with respect to teacher replacement, becomes even more questionable if one adds the declining enrollment figures to those of the State's retirement survey. Declines in student populations are often followed by the elimination of teachers with the least seniority.

If teacher replacement rates suggest that the implementation of desired changes will be slow in arriving then any hope for timely change must come from either inservice or other teacher professional-growth activities.

In Michigan, the amount of time devoted to inservice programs in public schools is often defined under a collective bargaining agreement modeled upon past practices which have been influenced by teachers

organizations (Michigan Education Association, Michigan Federation of Teachers), school board organizations (Michigan Association of School Boards), and administrative organizations. While the agreement typically defines the number of days each year that a district will require a teacher to participate/attend that district's inservice activities it does not normally define the topics of those inservices.

An examination of the present collective bargaining agreement of one large school district in the State of Michigan verified the limits such documents place upon inservice programs (Saginaw School District, 1987 - 89). In the collective bargaining agreement examined there were 186 actual work days which included only one inservice day for each of the two years of its existence. That means that in one of the largest school districts in the State of Michigan the school district has only six hours a year to conduct an inservice program for its teachers. The agreement does, however, allow the district to conduct additional inservice programs, if they occur during the regularly scheduled work day or the teacher/s involved volunteer to receive such training after school.

Assuming that the collective bargaining agreement examined is typical of those found in other

school districts in the State of Michigan, then the probability of successful inservice activities which Holly (1977) suggested should be of sufficient scope and duration will be limited by each district's ability to pay for its programs or the teacher/s willingness to volunteer extra time.

As with the conditions of teacher replacement in the State of Michigan, those relating to inservice activities suggest that the implementation of desired changes will be slow in arriving if only teacher replacement and inservice activities are relied upon. In effect, the present conditions of teacher replacement and collective bargaining suggest that the problem of timely and on-going implementation of desired changes in education through teacher education must rely upon the willingness of the teacher/s to participate/volunteer in such activities.

In summary, once again there has been a call from national boards, educational professionals, and state legislatures for an improvement in the educational system. From that call new standards in teacher preparation and continuing education rules have evolved in the apparent belief that educational improvement will follow. However, an examination of teacher replacement rates and the ability of local

districts to sponsor inservice activities paints a questionable picture as to when initial teacher preparation changes and state continuing education rules might become effective. Perhaps the solution to the implementation of change through changes in teacher education, under the present and possibly the future educational system/s, rests with a knowledge of what professional-growth activities teachers are involved with as they mature (to the extent that improvement is rooted in continuing professional development).

## Statement of the Problem

At present there is a lack of information concerning formal and informal professional-growth activities of precollege teachers. This study was designed to identify and examine the level of formal and informal professional growth activities of precollege teachers as they mature professionally. Specifically the focus was on a select group of science teachers.

## Importance of the Problem

The importance of initial teacher preparation and continuing education to improve the past and present educational system has been acknowledged by many. A 10 year Dialog ERIC search using the descriptors of

professional development, teacher improvement and professional associations generated a list of 87 articles. And the use of the same descriptors yielded a list of 112 dissertations from Dissertations Abstracts.

In the recent past, initial teacher preparation in Michigan included a college degree with appropriate course work and 18 semester hours in approved post-graduate courses to become a fully certified teacher. After June 30, 1992, a fully certified teacher will have to complete an additional six semester hours or an equivalent in continuing education units every five years from a state approved agency to maintain that certificate. All those who have been fully certified on or before June 30, 1992 will be "Grandfathered" and not required to take any additional preparation (Michigan Teacher Certification Code 1989).

With regard to continuing education Holly (1977) conducted a study to determine what personal-professional growth of educators was and those factors which contribute to it, with the intent of providing some insight into what might improve inservice education.

What Holly found in her study was that there were no clear distinctions in response to her questions

by grade level, teaching experience, gender or amount of graduate level education. However, she did suggest that the responses indicated a common desire of the respondents to be in "non-threatening environments" which would provide meaningful experiences for teachers.

In 1980 DeKarske, working in cooperation with the Saginaw County (Michigan) Professional Development Policy Board, surveyed all of the teachers and administrators in Saginaw county with respect to their perceived needs. The project was undertaken in light of research which suggested the importance of initial educator involvement in the planning stages of inservice activities to the success of any inservice activity offered.

What Dekarske found was that there were many common areas of interest held by the educators within the sample surveyed. However, he did caution that the design of the survey and the breadth of the sample would require future examination of educators by grade and subject to determine the true needs of those groups.

In 1978 Heitzeg looked at the formal professional-growth activities of staff in a Michigan

suburban school district . He defined formal professional growth in terms of college courses, district inservices and professional conferences. What he found was that there was a relationship of age and degree to participation in formal, professional- growth activities. As the age of the staff increased or a higher degree was attained (MA or BA + 40) the participation in formal professional activities decreased.

In light of his findings Heitzeg suggested that the effect of declining enrollment and the aging of the staff, in a system which uses seniority as a basis of teacher retention, would affect the vitality of the educational institution.

In 1987 Yovanovich examined continuing professional development of special education staff, as perceived by teachers and administrators. What she found was that teachers and administrators share a number of perceptions relative to professional development. However, there are differences in the greater variety of activities (informal) used by teachers vs. administrators and the perceptions those same administrators have regarding the level of professional-growth activity of teachers. The teachers of her study also acknowledged a change in their

definition of continued professional development related to their time in the career. The change Yovanovich noted was that professional development was no longer viewed solely as participating in graduate college courses or obtaining a master's degree. The respondents of her study identified professional development as the need to keep up with the changes and trends in their particular area of teaching through participation in a variety of activities .

In summary, there is a significant amount of information available concerning the value of and importance of initial and continuing teacher education. Unfortunately, none of those studies examined has of yet been integrated with the other to provide a clear picture of the professional growth activities of educators as they are conducted in practice as a product of time, professional maturity, and particular group.

## Purpose of the Study

It is the purpose of this study to identify and examine the level of formal and informal professional-growth activities of a particular group of science teachers (members of the Michigan Science Teachers Association - M.S.T.A.) as these are conducted in

practice and to examine the nature of relative changes of the acquisition of knowledge as those group members mature professionally.

Questions to be Answered by the Study

1. Are there differences in formal professional-growth activity of science teachers who belong to a professional organization, grouped by teacher age or degree level?

2. Are there differences in informal professional-growth activity of science teachers who belong to a professional organization, grouped by teacher age or degree level?

3. What is the relationship between formal professional-growth activity and informal professional-growth activity of teachers, grouped by teacher age or degree level?

4. Are there differences in teacher perceptions of the relationship between knowledge gained in formal professional-growth activities and the use of such knowledge within the classroom, relative to teacher age or degree level?

5. Are there differences in teacher perceptions of the relationship between knowledge gained in informal professional-growth activities and the use of such knowledge within the classroom, relative to teacher age or degree level?

Supplementary Planned Analysis

Data will also be analyzed to determine if there are differences in professional growth activity in terms of age or degree associated with gender or level of assignment (Elementary, Middle School, Junior High, High School).

## Significance of the Study

The importance of teacher preparation to the goals of the nation's educational system has been acknowledged by many. And changes in initial teacher preparation and certification have evolved with respect to those needs. Unfortunately, change does not always seem to occur at the rate at which it is often desired.

If a clear picture of both the formal and informal professional-growth activities of science teachers can be obtained it may suggest that teacher

participation is constant, albeit varied, and therefore a vehicle already exists to introduce new standards to those individuals who have been otherwise "Grandfathered." Or that same picture may suggest that there is a need to develop activities to draw "Grandfathered" educators into continuing professional development to bridge the period of changes in teacher preparation and standards.

In addition, the documentation of the level of informal professional-growth activities of a select group of teachers might suggest that there is a need for a serious evaluation of how and why those activities contribute to the professional growth of the individual teacher.

## Definition of Terms

### Formal, Professional-Growth Activity

College-credit classes, district-sponsored inservice education, and participation in professional conferences and workshops (Heitzeg, 1978).

Measure of Formal Professional-Growth Activity

The computation of Formal, Professional-Growth Activity hours will be determined in a manner similar to a study completed by Heitzeg (1978) with the exception of inservice hours. The computation used in his study for inservice hours was developed with regard to his ability to access teacher records directly. Because the population of this study does not have a similar data source available teachers surveyed will be asked to "estimate" to the best of their ability the time spent in inservice activities.

1 Semester Graduate Credit = 15 Hours
1 Term Graduate Credit = 10 Hours
1 Conference Day = 6 Hours
1 Inservice Education Day = Teacher Estimated Hours

Informal Professional-Growth Activity

Activities such as those identified by Holly (1977) and Yovanovich (1987) which have been identified as providing information of use to teachers and not identified as Formal Professional- Growth Activities.

## Measure of Informal Professional-Growth Activity

The identification of levels of Informal Professional-Growth Activity will be based upon teacher perceptions of their participation in identified Informal Professional-Growth Activities. Each teacher will select a survey response to indicate the relative amount of time during the past twelve months they have devoted to identified Informal Professional-Growth Activities as compared to the time devoted to such activities at the beginning of their career.

## Age Groups

There will be three age groups for this study: 22 - 34; 35 - 47; 48 - 65; and over 65. The age groupings are similar to those used by Heitzeg (1978) so that a comparison of data can be accomplished.

## Teacher Degree Groups

Teacher groups by college degree are: Bachelor of Arts/Sciences only; Bachelor of Arts/Sciences with at least 18 additional semester hours; Master of Arts/Sciences or Bachelor of Arts/Sciences with at least 30 semester hours; Master of Arts/Sciences with at least 15 additional semester hours; Master of

Arts/Sciences with at least 30 additional semester hours; Education Specialist; and Doctorate.

## Delimitations

A. It is not the purpose of this study to determine the relationship between knowledge obtained by the teacher and that transferred to and internalized by the student.

B. It is not the purpose of this study to determine the value of any particular professional development activity required by a school district, college, university, or government agency.

C. It is not the purpose of this study to determine the value of any professional development activity undertaken by the individual teacher.

## Assumptions and Limitations

### Assumptions

A. A survey of the M.S.T.A. membership will yield accurate information pertaining to the formal and informal professional-growth activities of its membership.

B. The responses of the teachers to the questions relating to the survey will be accurate.

C. The descriptions of informal professional-growth activities beyond those included in the survey are categorizable.

D. The Heitzeg methodology developed to examine the intensity of formal professional-growth activities of teachers in a suburban school district can also be used to describe the intensity of formal professional-growth activities of the M.S.T.A. membership.

E. Teacher perceptions of changes in Informal and Formal Professional-Growth Activities can be used to describe accurately the intensity of teacher participation in Professional-Growth Activities.

F. The participation of teachers in professional growth activities is a necessary component of school improvement.

G. The amount of exposure to professional-growth activities bears a relationship to the impact of such knowledge upon the individual.

Limitations

A. The surveyed M.S.T.A. membership is not necessarily representative of Michigan precollege science teachers as membership may indicate a greater degree of professional-growth activity of those who choose to belong.

B. The total number of surveys returned will affect the generalizability of findings.

C. All information from the survey is limited to the time period in which it is generated.

## Population of Interest

The population of interest for this study is the Michigan Science Teachers Association (M.S.T.A.). as defined by the April 1989, membership list.

The M.S.T.A. is a professional organization established in 1953 to bring together all those interested in strengthening and promoting science education in Michigan. Its membership includes precollege teachers, university professors, college students, staff members of the State Board of Education, media/materials suppliers and other interested individuals.

As of April 1989, there were 2659 memberships in the M.S.T.A.. While there is some classification of memberships such as regular, college, institutional, there is at present no identification of the membership with regard to actual level of instruction.

The services which the M.S.T.A. provides to its membership can be categorized into three broad areas: 1) An annual conference focused upon science education issues and science teaching strategies which allows members to obtain National Continuing Education Credits for conference attendance, 2) Informational Mailings and 3) Representation at the State and National levels. Only those who are Active Members will continue to receive the services of the organization while those individuals who become inactive will cease receiving literature from the organization. For a member to become active once again and receive the services of

the organization a member need only to pay his/her dues.

## Summary of Procedures Used in this Study

### Data Collection

A survey instrument which was designed through collaboration with the M.S.T.A. was mailed to 2287 members whose memberships suggested that they are science teachers. Each member was encouraged to answer all questions as completely as possible and return the survey instrument in an attached envelop.

The respondent was requested to answer questions in three areas; demographic, formal professional-growth activities, and informal professional-growth activities. Questions pertaining to the respondent's perception of the use of knowledge gained from identified activities within their classrooms was also included.

### Data Analysis

The responses to the returned surveys was transferred to computer disk for categorization and analysis under the headings of age, degree, gender and professional assignment.

The initial analysis of results was accomplished through a comparison of the responses of specific groups to the same question. Tables were generated which compared the mean responses to each survey question pertaining to professional-growth activity with regard to age and then degree. The intent of the tables generated, using mean values of responses, was to develop a general picture of activity which might suggest trends or changes in professional-growth activity as the professional matures.

A statistical analysis of precollege teacher participation in formal and informal professional-growth activities by age and degree was conducted using the Statistical Package for the Social Sciences. The analysis was intended to clarify the relationship of formal and informal professional-growth activities of the professional science teacher as they mature which was suggested through the generation of tables which compared only the mean values of responses. An Analysis of Variance was conducted to determine if there are significant differences within the age or degree groups with respect to the amount and nature of formal professional-growth activities in which they engage. And the Chi-Square test was used to determine whether there is any difference within the age or

degree groups relative to informal and formal professional-growth activity as the professional matures.

Supplementary Planned Analysis

Data were also analyzed to determine if there were differences in professional growth activity in terms of age or degree associated with gender or level of assignment (Elementary, Middle School, Junior High, High School).

## Overview of Chapters II-V

Chapter II includes a review of literature pertaining to the purpose of the study. In particular, the participation of teachers in continuing education and the role of professional organizations in sponsoring such activities will be examined. Chapter III includes a description of the population and instrument development, followed by a presentation of the study procedures used to collect and evaluate the data. The results of the data collection and its evaluation are presented in Chapter IV, and selected participant comments are summarized. A discussion of the problem in light of the findings of the study is

presented in Chapter V along with recommendations for future exploration in the areas of informal professional-development and the roles of professional organizations in continued professional development.

# CHAPTER II

## REVIEW OF SELECTED LITERATURE

This study was concerned with the development of a clear picture of the formal and informal professional-growth activities of a particular group of educators (members of the Michigan Science Teachers Association - M.S.T.A.) as these are conducted in practice.

As an initial step to the literature review a Dialog search of ERIC and Dissertations Abstracts using the descriptors of professional development, teacher improvement, and professional associations was conducted. A ten year review of literature yielded 87 articles from ERIC and 112 dissertations from Dissertations Abstracts which appeared to pertain to the subject of this research. After a review of the abstracts of the articles and selected dissertations further examination was limited to three areas:
1) literature focused on teacher professional development after entering the profession,
2) literature which pertained to teacher participation

and/or perceptions of professional growth in general, and 3) literature of organizations which identified membership professional growth activities. The following is a presentation of the literature identified and reviewed under the forgoing limitations.

## Teacher Professional Development After Entering the Teaching Profession

With the intent of establishing a link between personal-professional growth and inservice education, Holly (1977) conducted a study which drew upon literature in the area of inservice education, educational theory, behavior, and subject interview responses.

What Holly found in her literature review was that past professional development was typically mandated, remedial, and controlled by those in authority, a condition which her subjects indicated was still common. She also found literature which indicated that change in professional development, with regard to past practices, and an understanding of the teacher as a learner had already begun. However, she argued that there was a need to determine just how teachers, as individuals, personally-professionally grow before

inservice education could be improved in light of that knowledge .

To determine what personal-professional growth of teachers was, Holly used an interview questionnaire upon a volunteer sample of practicing teachers who were attending summer school at Michigan State University in 1976. The initial questions of her instrument gathered demographic information pertaining to each participant while the research questions were developed to determine activities of practicing teachers which have meaning to them, identification of sources of those meaningful activities, and descriptions or definitions of circumstances under which meaningful professional growth experiences and activities occur.

What Holly found in her examination of the responses to her interview was that the majority of the participants were individuals with one to six years of experience who possessed at least a BA + 15 semester hours of graduate education and were teaching with a provisional certificate. She found that based upon subject responses and frequency of responses twenty-two categories of activities of participation could be identified. The activity most often mentioned by her subjects was teacher conversations which occurred informally, while enrolled in university classes, or as

the result of the teacher's interaction while involved in other activities.

To better define and identify the desired beneficial activities of individuals, Holly asked each respondent to identify professional growth activities they would participate in if they had ten hours available for their own professional growth. Of the eighteen categories of activities identified, the top five were:

Reading
Plan/prepare/organize
Visit/Observe
Curriculum design/evaluation
Work with other teachers.

while the bottom five were:

Conferences/professional membership meetings
Work with administrators
Creative activities
Inservice education
Politics

From the categories of preferred activities and the comments in which they were referenced she suggested that teachers were concerned with the quality of life within their classrooms and the prospect of improving conditions through planning and preparation greatly appealed to them.

With regard to the identification of sources of beneficial activities an examination of the responses

of Holly's data indicated that teachers turn to other teachers sixty-three percent of the time and to supervisors, professors/universities or outside people less then ten percent of the time. The top five identified sources of beneficial activities were:

Other teachers
Reading
University Classes
Self/Experience
Teachers in Classes

Again it was teachers or reading to which teachers turned to for advice or help with classroom problems arising from their teaching situations. With regard to university classes Holly suggested that the comments of the respondents indicated that even their value was greatly enhanced by perceived interaction with other teachers.

For the most part Holly suggested that teachers were discriminating in the types of workshops or seminars that they would attend. She reported that the reasons for teacher's choices were often described in terms of teacher perceptions of an individual's knowledge and experience, availability, and willingness to share information in a non-threatening manner. Holly reported that no respondent referenced formally structured activities as beneficial unless they were in an informal and non-threatening atmosphere. University

courses which were valued allowed teacher interaction, were conducted by a knowledgeable individual who enriched the course, did not lecture them, built bridges from theory to practicality, and were not "forced" upon them under certification requirements. She suggested that teachers preferred to and felt good when they could pick and choose classes to suit their needs from a variety of offerings.

With regard to beneficial activities with colleagues, the five most frequently cited response categories were all informal, voluntary, and on the teachers own time. More often than not they were social in nature, lacking any formal structure and allowing the individuals to freely express themselves and exchange information and knowledge.

In general, Holly suggested that teachers found meaning first with other teachers, in personal reflection, or while creating, engaged actively outdoors or while reading. Teachers value informal experiences where they can learn from others in non-prescriptive ways. Whenever a teacher discovered personal implications "Personal-professional Growth " would occur.

In summarizing her study Holly suggested that inservice education will be of the greatest benefit to participants if it is designed to fit the needs of the participants and presented in an open, non-threatening environment which allows for individual reflection and choice of participation. If inservice education is to be an effective contributor to personal-professional growth, teachers must be allowed to and trusted to make decisions with regard to that growth.

In 1976 the National Science Foundation (N.S.F.) commissioned Research Triangle Institute (R.T.I.) to conduct a national assessment of science, mathematics and social studies education. The report , Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education (Weiss, 1987), consisted of three studies; a comprehensive review of pertinent literature; case studies of typical school districts; and background information pertaining to educational personnel.

In 1983 R.T.I. applied to the N.S.F. to conduct a second survey noting that major reports pertaining to science education were still relying upon the 1977 study as late as 1983. In 1984 R.T.I. received a grant from the N.S.F. to complete a similar national

assessment of education which would focus more on science and mathematics teachers, and their principals, and to compare the 1977 study and the new study to identify trends. In 1987, the R.T.I. completed and published the Report of the 1985-86 National Survey of Science and Mathematics Education.

The R.T.I. study involved a national probability sample of schools, principals, and teachers in kindergarten through twelfth grade. Teachers were selected from lists provided by participating principals in participating school districts. R.T.I. specifically noted that the use of principals to select teacher participants at random would be avoided due to concerns of sampling bias. Additional concerns and changes in sampling procedures required that sampling rates be adjusted for chemistry and physics teachers to insure a sufficient number of each due to the larger number of biology teachers. A total of 6,156 science and mathematics teachers were selected for participation in the 1985-86 study.

The R.T.I. study found that the typical science teacher had aged, had more experience than found in the 1977 study, and that there was no supportive evidence for concern with regard to science teacher retirement in the next decade. Similar to the 1977 survey the

1985-86 survey found that as grade level increases so does the percent of teachers with higher degrees. In particular, the percent of tenth through twelfth grade science teachers with degrees beyond the bachelors had significantly increased to sixty-three percent with eighty-four percent of tenth through twelfth grade science teachers having one or more degrees in science or science education.

With regard to individual state certification, the survey found that roughly five percent were only provisionally certified. Most seventh through twelfth grade science teachers are certified to teach one or more science subjects.

The professional development of science teachers was examined by R.T.I. in terms of teacher perceptions of their qualification, opportunities for professional development and teacher participation in professional development activities.

Elementary school teachers, kindergarten through sixth grade, indicated that they felt well qualified in most areas of instruction. Their responses to qualifications in the area of science, however, suggested that the majority feel only adequately qualified to teach science. In contrast, the majority

of secondary teachers, seventh through twelfth grade, in their responses to questions concerning qualifications indicate that only six percent of those responding felt inadequately qualified; a reduction from thirteen percent in the 1977 study. Posing the same question of qualifications of seventh through twelfth grade science teachers to secondary school principals yielded similar overall ratings for science teachers.

In examining professional development through college courses taken by teachers the study reported that many have not taken a college course in their subject area (science) in a number of years. While the decrease was found to occur at all grades, kindergarten through twelfth, the table of data reported suggested that the decrease in subject specific college coursework is greatest at the kindergarten through sixth grade levels.

Responses pertaining to attendance at professional meetings, conferences and workshops relating to science or mathematics teaching indicated that the amount of time was usually less than six hours for the previous year. With regard to subject-specific in-service activities fifty percent of kindergarten through sixth grade, thirty percent of seventh through ninth grade,

and twenty-seven percent of tenth through twelfth grade teachers reported no in-service time in science during the last 12 months. In contrast thirteen percent of kindergarten through sixth grade, twenty-two percent of seventh through ninth grade, and twenty-five percent of tenth through twelfth grade teachers spent more than six but less than fifteen hours on subject specific in-service activities in the previous year.

An analysis of teacher responses to preferred times of attendance at professional development activities indicated that at least fifty-seven percent of all three teacher groups would very likely attend activities if they were offered on a teacher workday. Other time preferences for in-service programs for all three teacher groups was summer with at least thirty-two percent, after school at least twenty-eight percent, evenings at least fifteen percent, and Saturdays at least twelve percent.

To determine teacher preferences with regard to other recognized means to stay current or learn of new developments teachers were asked to choose from a list of thirteen sources. Of the thirteen available sources, the top three for kindergarten through sixth grade teachers were in-service programs (fifty-three percent), newspapers/magazines (forty-five percent),

and other teachers (forty-four percent). The top three choices for seventh through ninth grade teachers were journals (fifty-two percent), college courses (forty-six percent), and in-service programs (forty-one percent). The top three choices for tenth through twelfth grade teachers were journals (fifty-four percent), other teachers (forty-three percent) and college courses (forty-one percent). The least often selected sources were publishers, sales representatives and state department personnel.

Sanford (1988) reviewed literature pertaining to the conditions of professional development of beginning science teachers in the United States and other countries. Among her findings was that there is a scarcity of research on science teacher preparation and development on the job as compared to other topics in the area of science education. And of that research pertaining to science teachers, a significant amount was concerned with preservice teachers or programs and not beginning teachers. Another finding was that while there has been an increase in the body of research and program efforts focused on teacher induction, almost all of the research has ignored differences among content areas or differences between elementary and secondary programs.

To demonstrate a difference between teacher content areas Sanford used a comparison between the areas of mathematics and science which are traditionally lumped together. She suggests that observations of mathematics instruction show that it is primarily taught from well defined and sequenced textbooks while science is not. Science instruction has to consider a larger amount of concepts and therefore does not appear to have a consensus about goals or a core curriculum which would allow instruction similar to what one would observe in a mathematics classroom.

To further develop the differences between the needs of beginning science teachers and the needs of beginning teachers of other content areas Sanford cites the research of Emmer (1987) who examined the experiences of two reading teachers and two science teachers. Although only one of the two reading teachers had had previous experiences in teaching reading there were few identified differences in the instructional activities used by the two teachers. On the other hand, the science teachers in the study demonstrated a greater diversity in their instructional activities. An explanation for the differences found in the comparison of beginning teacher instructional

activities was that the reading program had identified norms and close teacher interaction while the science program had neither.

Sanford also referenced research which reported concern pertaining to the areas of content preparation of beginning teachers, assignment mismatch, and a growing awareness that university study of an academic discipline may not provide the kind of knowledge that a teacher needs to transform that knowledge into classroom activities. She suggested that in light of that research the beginning science teacher must grapple with their knowledge, their assignments, and a wealth of content, before they begin to teach.

As for the identification of sources of assistance for the beginning teacher Sanford cites one of her earlier studies which compared the planning activities of beginning and experienced teachers. She reports that none of the beginning teachers described science colleagues or curriculum guides as major sources of information. Student teaching experiences were mentioned only when there was a match in those experiences. She also reports that there may be documents which describe what should be taught. Support for beginning science teachers to translate

their knowledge and experiences into instructional activities does not, however, appear to exist.

Sanford further reported that an examination of the literature pertaining to the enculturation of beginning teachers via the secondary department interaction or under departmental chairman leadership suggested a rather bleak situation. As an example of the situation Sanford refers to a study by Little (1985) which reports that there appears to be limited time available for teacher exchanges of information and the apparent norms of teaching suggest that each teacher must learn by independent trial and error. And in a study by Hord and Diaz-Ortiz (1986) they reported that while some do observe classroom teaching and offer assistance, the majority of department heads have received no training on how to help teachers with instructional problems or professional growth.

As a recommendation to change the conditions of beginning science teacher professional development described in the literature Sanford suggests that action be taken in the four following areas:

1. Acknowledgement of the beginning teacher's expertise and student teaching experience.
2. Initial inservices on instructional planning and classroom management for beginning teachers.

3. Recognition of the special needs of first year science teachers with regard to planning and preparation.

4. Creative solutions to enhance science teacher interactions within the secondary school.

In 1983 Youatt conducted a study "Informal Activities Identified as Contributing to the Professional Development of Selected Michigan Home Economics Teachers." While the intent of the study was to identify informal activities which teachers perceived to be contributors to their professional development it also attempted to determine the relationship of activities undertaken to teacher characteristics and motives.

What Youatt found in her literature review was that professional development has often been identified as inservice education, however, it has also been identified as a personal process in which the teacher is self-motivated to seek out relevant activities. She found that Adult Learning theories and research have suggested a strong relationship between informal learning activities and adult behavior. Participation in formal professional development activities was often hindered by time constraints of home economics teachers.

To identify the informal activities of home economics teachers Youatt used what she described as a two phase process with twenty teachers who voluntarily participated from a sample of home economics teachers drawn from three Career Education Planning Districts. The first phase required that subjects meet as a group and discuss/brainstorm concepts relative to the study. The second phase required that the teachers of the group respond to a questionnaire relative to the questions of the study.

What Youatt found through content analysis of the responses to her questionnaire was that the top three activities of home economics teachers were Home and Family Living Experiences, Courses and Workshops which were offered through commercial enterprises or community education, and Popular Media. What she also found was that the activities which were identified as useful by respondents were those which provided information to suit the needs of the teacher and enhanced the teacher's attitude toward or view of students.

She reported that, with regard to the sample of her study, teachers with more than six years of experience identified nearly four times as many informal activities as teachers with six or fewer years

of teaching experience. Those teachers with six or fewer years of experience were more likely to identify courses or workshops than those with more than six years of experience. In addition, the frequency of informal teacher activity was greater in those districts which restricted formal activity participation based upon available resources.

In summarizing her findings Youatt states that there appears to be a relationship between the stage of a home economics teachers career and life to the activities which a teacher believes are most beneficial, and the availability of formal professional development activities.

## Teacher Participation in and Their Perceptions of Professional Growth Activities

In 1979 Burden conducted a study pertaining to "Teachers' Perceptions of the Characteristics and Influences on Their Personal and Professional Development." His study was undertaken with the intent of integrating and applying human and career development research and theories to teacher development. The desired end result was the identification of developmental patterns and changes in

teachers as they continue in their careers as well as causes of such patterns and changes.

In his study Burden reviewed literature in the areas of Human Development, Career Development, and Characteristics of Teachers and the Occupation of Teaching.

What he reported in his literature review pertaining to Human Development was that there are theories of change which have been developed with regard to age, psychological behavior, and human needs. Most developmental studies pertaining to adult development focus upon either ages of development or psychological processes related to age.

With regard to career development he reported that it is often defined as an orderly movement of an individual with appropriate skills either horizontally or vertically. Some have described career development based upon views of human development in terms of life or age stages.

With regard to Teachers and the Occupation of Teaching he reported that the literature suggested that teachers were social, conservative, conscientious, conforming, emphasized control of self, adaptive to others needs and demands, and were resistant to change.

He found literature which described the occupation of teaching as lacking an upward career path. The literature suggested that for a teacher to move upward required that they go into a non-teaching support/specialist position or become an administrator which in effect is a renouncement of teaching as an occupation. Or that the teacher may move to another school/district which offers better benefits or improved working conditions.

To determine what were the changes which teachers perceived to have occurred in their careers Burden used a focused interview with fifteen elementary teachers to obtain information. The teachers were selected to meet specific criteria relative to experience, assignment, gender, and period of teaching. The information accumulated from the interviews was then examined and categorized into the areas of personal and professional development, influences of personal and professional environment on development, influences of supervisory practices upon development, and preferences pertaining to facilities and supervision relative to development.

What Burden reported as significant from his examination of the interview information was that there was evidence of stages of career development for teachers. The progression from one stage to another

was orderly and required that teachers undergo changes with regard to their knowledge, attitude, ability, and job performance within each stage before advancing to the next stage. There is a decrease of changes in teachers as they progressed beyond the fifth year as compared to the first four years.

An additional finding of his study was that there appeared to be what Burden identified as "year phases" which applied to each teacher's development. He stated that there were distinct characteristics associated with his three categories of "year phases". The first year he identified as a time in which teachers were concerned with management and professional survival skills. The second, third, and fourth years were concerned with beginning to try new teaching methods, exhibition of confidence, and a greater perception of teaching complexities. The fifth year and beyond was a time in which teachers appeared to have a good command of what, why, and how they responded to the needs of their students in their particular working environment. They were willing to try new methods, accepted changes as they occurred, and began to look for ways to meet their own needs.

As for the sources or causes of the developmental changes, Burden suggested that they could be found in

theories relating to career and human development. Teachers in their early years desire to amass the skills necessary to be successful and to determine if teaching is actually to be their career. They then enter a stage in which they begin to explore other ways of being successful professionally, personally and to limit the tensions associated with teaching.

In addition to the effect human development had in shaping teacher's personal and professional development he reported that his analysis of data indicated that other teachers greatly influenced their development. Teacher turnover, while attributed with bringing in new ideas, often slowed teacher interaction due to the time needed to develop new relationships.

He found that as time passed teachers accumulated knowledge which led to changes in job performance. And that the personal lives and professional lives of teachers interacted in both positive and negative ways. However, there were few positive influences associated with supervisors or administrators with regard to the professional or personal development of the teachers in his study.

In 1980 DeKarske, working in cooperation with the Saginaw County Professional Development Policy

Board, surveyed all of the teachers and administrators in Saginaw county with respect to their perceived needs. The project was undertaken because of evidence pertaining to teacher replacement and past research which suggested the importance of teacher perceptions and involvement to the success of any inservice activity.

What Dekarske found was that there were many common areas of interest held by the educators within the sample surveyed. However, he did caution that the design of the survey and the breadth of the sample would require future examination of educators by grade and subject to determine the true needs of those groups.

In 1987 Yovanovich examined the professional development of special education staff in terms of teacher and administrator perceptions. She broadly defined in-service education to encompass any planned program for the improvement of individuals within an educational setting and professional development as an individual process more influenced by administrative and environmental factors rather than available programs.

In her study Yovanovich reviewed literature which pertained to continued teacher professional development and adult learning which related to teacher professional development.

What Yovanovich found pertaining to continued professional development was literature which justified the need for continuing professional development in today's world of knowledge, technology and declining enrollments. The suggestion that as teaching staffs become more stable, with fewer "new" staff members natural sources of vitality and fresh ideas would disappear. A description of inservice education for teachers was defined in terms of formal coursework toward a degree beyond a Bachelors, or remedial, inspirational, lecture, or other activity required to advance in one's career or fulfill requirements for certification or advancement in salary. As early as 1975 inservice education had been broadly defined as active involvement of the teacher in group and/or individual pursuits which occurred after initial certification. Teachers are learners who continue to grow throughout their lifetimes. There was a considerable amount of literature pertaining to teacher perceptions of inservice education, often defining it in terms of administrators' agenda, irrelevancy,

ineffectiveness etc., which at the same time suggested a desire of teachers to participate in meaningful activities developed with regard to the nature of the adult learner.

What she found pertaining to adult learning was literature which suggested that developmental concepts do provide differential explanations for adult behavior. Among those explanations which she felt related to teachers as adult learners were those of Lindemann (1926) which drew a relationship between each individual's life-centered orientation, experience, motivation, need for self-direction, and age differences. She also cited literature which supported the need to apply adult learning knowledge to future inservice and professional development activities. And finally she also referenced the study refered to earlier by Burden (1979) which proposed the development of a career cycle model for teachers as learners.

To determine the perceptions of special education teachers and administrators Yovanovich developed an interview schedule to be used with all participants. The participants were volunteers from two special education districts in the state of Indiana. The teaching sample included 36 female teachers and 2 male

teachers. The administrative sample included 13 male administrators and 2 female administrators.

What Yovanovich found was that teachers and administrators share a number of perceptions relative to the need for and definition of professional development activities. Administrators identified the same areas as teachers did with regard to teacher preferences of professional development activities and both valued activity in professional organizations. Administrators also identified the same obstacles to professional development activity for teachers such as time, cost, and outside responsibilities of community and family. However, there were identified differences in the greater variety of activities (informal) used by teachers vs. administrators and the perceptions those same administrators have regarding the level of professional-growth activity of teachers. And there was an acknowledgement by teachers of a change in their definition of continued professional development related to time in their teaching career. Professional development was identified as being more than attending college courses or obtaining a master's degree. It was identified as a variety of activities to assist the teacher with keeping up with the latest trends in their profession.

From her responses Yovanovich suggested that continuing professional development should be varied in nature and developed with regard to knowledge pertaining to the adult learner. It should be a mixture of formal and informal activities developed to suit the individual needs and learning styles of teachers. The activities should provide for informal interaction of the participants so as to allow an exchange of and integration of new ideas with their own experiences. There should be collaborative efforts of both teacher and administrator to build upon their similar perceptions to develop professional growth activities which are more likely to succeed and accomplish goals. Finally, effective professional growth activities will require long term commitments of teachers to continuing education.

In 1978 Heitzeg looked at the formal professional-growth activities of staff in a Michigan suburban school district with regard to the degree-level and age of staff members. He defined formal professional growth in terms of college courses, district inservices, professional conferences and activity in terms of hours of participation. His purpose for the study was to develop and test a model

which could determine the impact of declining student enrollment in public schools on staff development.

In his literature search Heitzeg reviewed materials which pertained to enrollment-forecasting techniques, approaches to and effectiveness of inservice education, and the impact of declining enrollment upon the educational institution. What he found pertaining to enrollment-forecasting was that, baring migration patterns of people, the decline in the number of kindergarten through twelfth grade students was well documented and reasonably accurate. With regard to the professional growth activities of the legal, medical, and funeral professions he found that professional growth is accepted, voluntary, and often required by each of the examined professions, if not the state, as a requirement of continued public practice. However, of the three forms of professional growth activity, college classes, district inservices, and professional conferences, he found little data to support the notion that conference attendance had a significant impact upon professional performance. With regard to the effects of enrollment decline he noted that some were positive in terms of space availability for overcrowded systems. However, in districts which have experienced a drastic reduction in enrollment

entire buildings have been closed and staff layoffs have occurred. A situation which he reported raised some concern with regard to the practice of seniority layoff and the differences between new teachers and older teachers.

To determine the level of formal professional-growth activity of his subjects, Heitzeg used a survey instrument to determine college course hours, days at professional conferences in terms of hours, and hours spent in teacher-inservice activities. The subjects of the study were randomly chosen from twelve categories derived through the product of degree-level and age in one particular suburban school district. An attempt was made to insure that at least twenty but no more than thirty-five were selected for each category. A total of 304 subjects were drawn but data were available from only 290. A further examination of the sample selected indicated that sixty-three percent were female, thirty-seven percent were male, fifty-three percent were elementary assignments, thirty-three percent were secondary assignments, fourteen percent were special education, therapist, social worker, psychologist and curriculum consultants.

From the responses to the survey Heitzeg found a range of activity which varied from 0 to 628 hours.

His statistical analysis of total professional-growth activity suggested that younger teachers are more active. Teachers with the highest level of formal professional-growth activity have achieved the highest college degree level.

An analysis of interaction between age level and degree level detected no interaction relative to professional-growth activity. However, tabular data suggested to Heitzeg that the least active is an older teacher at the B.A. level and that there is a tendency toward less activity at all degree levels. He also found that the oldest group at MA+15 to 30 are more active than their younger counterparts at the BA + 40 or MA level. If the BA + 40 /MA group were ignored then there would be a consistent increase in formal, professional-growth activity, as degree increases and a consistent decline in formal professional-growth activity as age increases.

To determine what the consequences of a declining enrollment would have upon the levels of professional-growth activity in his school district Heitzeg developed and used a model which took into account his findings and a reduction of fifty students a year. What he found was that as the student enrollment decreased there would be layoffs of the least senior

teachers, typically younger, and as a result a decline in district professional-growth activity might occur.

In conclusion Heitzeg argues that if only the formal professional-growth activity of teachers is acknowledged then the data suggest that teachers may become relatively less skilled with time and the vitality of an educational system will suffer. However, he cautions, that an assumption of the study was that professional educators do grow in knowledge and skill in addition to the formal activities identified in his study. He refers to such activities as "informal" such as staff conversations, observations of other teachers, and evaluations by supervisors. Since one goal of formal education is to foster the self-initiated or self-directed activity of the learner, then those activities, whether formal or not, which are undertaken by an individual may contribute to their continued growth.

Ost and Baird (1989) examined and compared the perceived sources of experienced science teachers' skills and knowledge with other experienced teachers who earned Alabama certification in the same time period. To do so they surveyed 1260 Alabama teachers who held at least Master's degrees as of June 1985. The survey instrument used was originally designed to

evaluate teacher education programs in light of state standards.

Of the 610 surveys which were returned by the surveyed teachers 491 were identified as teachers and therefore useful to their study. The responses from the 491 teachers were analyzed under the categories of 1) Instructional and Classroom Management, 2) Instructional Strategies and Techniques, 3) Learner as an Individual, and 4) Social and Professional Foundations of Teaching.

The results of the analysis suggested that as a group the majority indicated that their knowledge of Instructional and Classroom Management was derived from graduate education or experience. The responses of science teachers were not found to be significantly different from the general population being studied.

The responses to questions pertaining to Instructional Strategies and Techniques suggested that the sources of that knowledge in six out of the eight areas was primarily graduate education or experience. A significant difference between science teachers and others was found only in the use of a variety of appropriate instructional materials and media.

The responses to questions pertaining to Learner as an Individual indicated that teacher knowledge was derived from graduate education or experience. A significant difference between science teachers and other teachers was found only in the area of adapting materials to individual differences and relating materials to students' experiences.

The responses to questions pertaining to Social and Professional Foundations of Teaching suggested that in six of the nine areas examined the majority of the teachers indicated that their knowledge was derived from experience. Only in the area of working with multicultural students was there a significant difference between science teachers and the rest of the study group.

As a result of their analysis of teacher responses Ost and Baird (1989) have suggested that science teachers view their sources of knowledge in much the same way as other teachers with the exceptions of media usage, adapting materials to students, and working with multicultural students. Both science teachers and the other teachers surveyed attributed the majority of their knowledge in the areas of, Instructional and Classroom Management, Instructional Strategies and Techniques, Learner as an Individual, and Social and

Professional Foundations of Teaching to either graduate education or experience.

To explain the results of their survey Ost and Baird cited literature which suggests that the beginning teacher is concerned first with survival and management skills. They then progress to a period of personal growth in which they examine their understandings of teaching and specific content. The result is that the continuing development of a teacher's skills and knowledge is tied to both experience and previous professional training which has allowed them to establish their need to know. Therefore a teacher's perception of source of knowledge and skills is affected by their experience/s.

In 1985 Saslaw presented a paper entitled "Survey of Professional Organizations, States, and Teacher Centers: Inservice Education and Professional Development" at the annual meeting of the American Association of Colleges for Teacher Education. The intention of the paper was to identify the current state of inservice and staff development programs with the belief that a review of the present conditions would provide useful guidelines at a national level.

What Saslaw reported from her survey results was that forty-three states and the District of Columbia have plans which are either mandated by law or have guidelines for local district inservice or professional development activities. Of those which mandated inservice hours the requirements were often tied to recertification at intervals.

With regard to the formerly government-funded Teacher Centers only thirteen out of the ninety listed responded. Of those which responded there was an indication of greatly reduced programs with poor attendance at offered activities. The decline of Teacher Centers, Saslaw suggests, might be due to a lack of equal participation of professional groups with respect to decisions of the centers or it could be due to changes in the teachers themselves. And if it is changes in teachers then new forms of encouragement beyond that of degree attainment might be needed.

Of the professional groups contacted to determine their view of their organizations part in inservice and professional growth activities, Saslaw found that there was a commonality, which was to provide assistance. And in two of the organizations there was expressed a desire to set standards for inservices and staff

development with the intent of improving the profession.

As a final remark, Saslaw states that there is interest in the area of staff development and inservice education; however, it is her opinion that one cannot see this interest as a top priority item.

In 1983, W. John Smyth and Colin Henry presented the paper "Case Study Experience of A Collaborative and Responsive Form of Professional Development for Teachers," to the Australian Association for Research in Education. The intention of the study was to suggest that viewpoints of teachers regarding what works in classrooms should be considered as a basis of change. However, a mechanism to focus teacher viewpoints, such as clinical supervision, is needed if collaboration and critical reflection are to occur.

The study occurred over a period of six months with teacher participants in 4 primary schools and one high school. During the period of study the participants became active observers and consultants who shared their observations of colleagues teaching with those same colleagues in non-threatening exchanges.

In the design of the study Smyth and Henry developed a "'follow through' in-service model" to address what they felt were time and authoritarian shortcomings of past clinical supervision inservices. In particular, their model was intended to acknowledge the teachers' legitimate need for control and ownership while at the same time demonstrate the need for external support, teamwork, and follow through.

What Smyth and Henry found was some skepticism of their actual intent. The need to communicate areas of concern or hear from other teachers was a strong theme. Questions of who and why teachers became involved led to the realization that there were personal agendas held by the participants. Smyth and Henry suggested that the recognition of personal agendas was a significant finding in that they believed there to be a strong tie between the success of implementation of a process and early involvement. In addition, they felt that there was a strong tie between the success of implementation not only to the participants but to the supportive role entered into by the principal.

In reflecting upon their study of the implementation of clinical supervision using their "'follow through' inservice model" Smyth and Henry strongly suggested that active cooperation of all

members of the educational community coupled with voluntary involvement is clearly the path to pursue.

## Organizations and Professional Growth Activities

In 1982 Douglass and Kahle (1983) surveyed a random sample of members of the National Association of Biology Teachers (N.A.B.T.) with the intent of developing a demographic, educational, employment, and professional activity profile of the entire membership and a future concern of examining the roles of women in biology education. In 1985 the results of the 1982 survey, with an emphasis upon women, was published in Women in Science: A Report from the Field (Kahle, 1985). Although the focus of each report was slightly different, the results which identify the professional characteristics and activities remain the same and thus both reports are reviewed together.

The survey was sent to a random sample of approximately 20% of the membership of N.A.B.T. (5000) with a return of 48% of those sampled (a total of 509 responses). The questions of the survey were of two types; Likert and forced response multiple choice. Only the results of that survey which would be of value to this project will be reported.

Based upon prior knowledge of N.A.B.T. membership Douglass and Kahle have suggested that the majority of members are male. They found that over sixty-five percent of those members are married. At the time of the survey seventy-five percent of the respondents were between thirty and fifty-five years of age with fifty percent of the total falling between thirty-five and fifty years of age. Douglas noted the age stratification and suggested that it may be due to declining enrollments and the forced layoff of teachers with less than 12 years of experience. The reported experience of biology teachers in the classroom was forty-two percent with eleven years to twenty years, eighteen percent with six to ten years, and twenty-four percent with five or fewer years with their present employer.

The professional activities reported indicated that teachers were involved within their school district, attended professional conferences, and read journals. Of those responding, more than ninety percent were active in departmental matters with eighty to eighty - five percent indicating influence at the institutional level. Attendance at professional organizations was reported in such a manner as to suggest that seventy-five percent of respondents have

attended at least one professional meeting a year. The identified attendance level Douglas suggested may have a relationship to the costs of attendance which nearly fifty percent of the respondents indicated was paid for from their own funds. The reading of two or three journals regularly was reported by half of the respondents.

In 1986 Michael Neuschantz and Maude Covalt (1988) on behalf of the American Institute of Physics (A.I.P.) conducted a nationwide survey of secondary school physics teachers and published their findings in Physics in the High Schools: Findings from the 1986 - 87 Nationwide Survey of Secondary School Teachers of Physics. The intent of the survey was to develop current baseline data on all physics teachers in the United States of America. In particular the survey focused on individual background characteristics, conditions of employment, professional development interests and activities, teacher approaches, and experiences in teaching. It also gathered information pertaining to the structure and availability of physics classes nationwide.

To determine the sample for the nationwide survey a master list of schools with desired characteristics

was obtained from Quality Educational Data. A total of 3631 schools of the listed 23,161 schools were identified to be included in the sample. Letters defining the purpose and requesting permission to conduct the survey were then sent to each chief state official, state science supervisor, and superintendent or private school administrator. Of the 3472 responding schools, 2846 offered classes in physics which were taught by a total of 3301 teachers. And of the 3301 teachers identified multiple mailings and phone calls achieved a response rate of seventy-five percent. Only the results of that survey which would be of value to this project will be reported.

The demographic results indicated that three-fourths of the respondents were male, had a median age of forty-one and fifteen years of teaching experience. Almost two-thirds held graduate degrees while only one-forth appeared to have earned a degree in physics, including eleven percent at the graduate level. Few described their assignments as primarily devoted to physics. There are many physics teachers who by virtue of numerous years and experience, even without the academic or certification credentials, have acquired considerable mastery of the field and methods of teaching it.

To better understand the characteristics of physics teachers Neuschantz and Covalt compared the responses of teachers in terms of gender, specialization in physics and years of teaching experience. They reported that there were fewer female physics teachers and of those they were less likely to hold a degree in physics, have had physics-related work experiences, and were more likely to have been "drafted" into teaching physics than men. In terms of specialization, which they described as being equally dependent on initial training and physics teaching experience, they found few differences in approaches to or attitudes in teaching physics. However, they did report a difference in confidence in teachers relative to the amount of college-level physics courses and experience.

The examination of teacher responses relative to years of experience suggests that the more senior the teacher is the more likely they are to stay on until retirement. The highest rate of attrition relative to responses of the survey was found to happen within the first five years. It was also found that as years of experience increase so does attendance at professional meetings, institutes and workshops; contact with physics or other science teachers; percent with

graduate degrees; the amount of time devoted to laboratory exercises increases, and the perception of individual confidence increases.

The findings pertaining to professional development indicated that seventy-nine percent cited science journals as a means to keep up to date followed by the mass media. Attendance at one or more professional meeting, workshop, or institute, within he last two years was reported by seventy percent of the respondents with attendance at professional meetings being the most common activity of the three. In contrast, a small percentage reported school science specialists at the state or district level as sources of information.

Killian, Wood, and Bell (1980) discussed and presented some recommendations for professional development of teachers in "Last Call for Professional Self-Improvement." Although the article itself was not a study or research report pertaining to professional development for teachers it did identify a number of conditions and concerns regarding professional development of other organizations and attempted to apply those to teachers.

Killian, et.al. identified three conditions pertaining to professional development. The first condition was a trend in many states to enact mandatory continuing education laws pertaining to those who provide professional public services such as doctors, nurses, lawyers, engineers, architects, optometrists and pharmacists. The second condition was control. Interestingly enough, only the legal profession is identified as actually controlling continuing education through institutes offered by it. Even the medical profession, doctors and nurses who have medical practitioners on their boards, does not have the total control of continuing education which the legal profession appears to have. In contrast, the boards of education which exert control over teachers are generally composed of noneducators. The third condition was credibility of present boards of control in light of public sentiment regarding lawyers, doctors, accountants and engineers.

In light of the conditions and concerns identified in other professions, Killian et. al., suggested that educators still would be wise to take on the task of controlling their own continuing education. There are complexities of the educational system which require solutions which must come from within and cannot be

generated from without. However, if educators are to be successful in their attempts to gain control they must be willing to address the issues of continuing education, control, and credibility. The disregard for inservice education expressed by professional organizations in education, a form of continuing education, must somehow be eliminated. Educators must support and accept continuing education both individually and in the public's eyes. Educational practitioners must be willing to share control with others who are knowledgeable in the area so as to eliminate the public's concern over conflict of interests such as perceived to be present in the legal and medical professions. Teachers, administrators, and teacher educators should focus their energies on cooperation rather than on issues of control to demonstrate their desire to maintain professional standards and thus establish credibility. And educational professionals should learn from other professional organizations and incorporate that knowledge with the needs of education to establish credibility. If they do not take action, however, they will continue to be subjected to legislative actions intended to do what educators appear unable to do.

Within the original ten year literature search one article listed pertained to the continuing education of physicians, "Continuing Education of Physicians: Conclusions and Recommendations," (Mayer, et.al. 1980). Although the article was primarily devoted to the continuing education of physicians, its value to this study is based in the common references and comparisons found in educational literature to the continuing education of physicians. There was an interesting similarity to the conditions of continuing education and professional development of teachers.

The purpose of the article was to identify the present conditions of continuing medical education and to suggest directions to improve those identified present practices, using a number of past studies undertaken by the Association of American Medical Colleges and others.

In the report, there was emphasis placed upon the importance and value of continuing medical education to the physician. The authors stated that continuing medical education is valuable to physicians because it can improve the competence and performance of the professional with regard to the patient. But before continuing physician education can accomplish the desired goals there are a number of factors which would

affect the planning, participation and success of continuing education to be addressed.

Among the factors cited as having an influence upon continuing medical education were those of the individual physician characteristics, physician needs and the complex nature of each individual's practice. Other factors identified as affecting the development of continuing medical education were rapid expansion due to a market-based economy, ad hoc faculty, a continually changing student body, mandatory state and specialty requirements, and the limited application of sound educational methodologies to continuing education programs.

With regard to the actual participation of the physician in continuing medical education the study reports that the most common form undertaken is category one credit. Category one credit documents registration by the physician at a course offered by an institution or organization which is accredited to do so. At present the success of continuing education is measured only in terms of accumulation of credit hours rather than the documentation of impact upon the health care delivery system.

In response to the identified conditions of continuing medical education, Mayer suggests that it should be closely tied to the physician's needs. It should encourage individual introspection and the identification of needed education, it should not be mandated without any evidence of a beneficial effect. The courses should be developed for the adult learner and enhance the abilities of the physician to continue to learn. The cost of continuing education should be covered from a number of sources. There should be cooperation in attaining quality continuing medical education through the formation of a committee dealing with medical education with representative members from medical organizations, societies , and government.

In an attempt to better understand the nature of continuing medical education in the State of Michigan a recent copy of Continuing Medical Education Requirements for Physicians Licensed by the Michigan Board of Medicine (March 1988), was obtained from the Department of Licensing and Regulation. An examination of the document revealed that for a physician to hold a Michigan license they must show evidence of completion of 150 hours of continuing medical education over a three year period prior to relicensure. Continuing education may be earned in any of the six categories of

continuing medical education, however, seventy-five hours must be in category one. The categories of continuing medical education (CME) can be described (briefly) as: 1) Accredited CME Courses which are offered by the American Medical Association or the Michigan State Medical Society, 2) Nonaccrediated CME courses, 3) Teaching, 4) Books, Papers, Publications, and Exhibits, 5) Unsupervised Education such as self assessment, self instruction and 6) Full-time Graduate Training. The proof of participation in categories one and two are certificates of attendance, letters from director/s are used in categories three and six, a copy of the article published in category four, and a letter describing any non-supervised education in category five.

To better identify category one continuing education credits letters of inquiry were sent to both the American Medical Association (A.M.A.). and the American Osteopathic Association (A.O.A.). Responses were received from both. Unfortunately an examination of the materials received in response to the inquiry did not better define the respective roles of the A.M.A. or A.O.A. in terms of continuing medical education beyond strongly suggesting its importance. However, the literature from the A.M.A. did indicate

that twenty-three percent of their members are primarily interested in medical and scientific journals, scientific conferences, seminars, and educational materials. It also indicated the size of the organization, 293,535 vs. total population of physicians 600,000. While the size in itself may or may not be important, the fact that the State of Michigan recognizes continuing medical education sponsored by the A.M.A. as category one credit may suggest something with regard to professional anizations and continuing education.

## Summary

Professional development after entering the precollege teaching profession has been found to consist of both formal and informal activities. Formal professional development activities have been described as activities which typically have been mandated and/or controlled by those in authority such as college courses and teacher inservices. Informal professional development activities have been described as activities which a precollege teacher enters, based upon teacher identified professional and personal needs. Examples of informal professional development activities are reading of journals and newspapers,

planning lessons, observing other teachers, talking to other teachers, travel or any other activity in which a teacher finds professional meaning. In addition, informal professional development activities have been found to take place while teachers were active in formal professional development activities. At present the literature suggests, however, that present research has only identified formal professional development activities as having a measurable effect upon the individual participant. Studies to determine the effect of formal professional development activities upon the professional teacher have been able to rely upon cause and effect methods which have used contact hour units, credit units, or quantifiable units not yet associated with informal professional development activities.

In general, teachers have been found to be discriminating in the types of formal and informal professional development activities they would participate in if allowed choices. The selection of activities has been found to be based upon teachers perceptions of not only the knowledge to be gained in an activity relative to teacher professional needs but a concern for the environment in which an activity was presented and the stage of the teacher's career.

Career development and human development have been found to affect teacher professional development activity. There appears to be a sequence of changes in teacher activities relative to career development and human needs. Changes in the level of formal professional development activity relative to the age of teachers and the degree held have been identified. Changes identified with the needs of beginning teachers vs. seasoned teachers have been identified and appear to occur more often during the first few years after an individual becomes a teacher. And the effects of teachers personal lives upon their classroom teaching practices have been identified.

Comparisons of professional development activity of science teachers with regard to the level of assignment suggest that there is a difference which appears to be related to the level of the teaching assignment and the stage of the teaching career. The preferences for particular types of professional development activities of precollege science teachers were found to vary relative to the level of assignment as did reported attendance at college, science-specific professional meetings and inservices. The needs of beginning science teachers were found to be similar and yet different from other beginning teachers. The

differences between beginning teachers of different content areas were suggested to be due to the nature of science and the methods required to convey the knowledge of science to each student.

There was no literature found which compared the levels of formal or informal professional development activity of science teachers relative to age or degree level. Neither was there any literature found which would suggest any relationship between formal and informal professional growth activity of science teachers as they matured professionally.

Within the most recent literature examined, which identified the average age of the nation's science teachers with regard to retirement, there was no supportive evidence found for concern in the next decade. The implication is that the present science teaching staff identified in the most recent national study will be teaching into the next decade.

An examination of literature pertaining to the continuing education of physicians, whose activities have often been cited in educational literature to compare and contrast those of precollege teachers, suggests the importance of the professional organization and the individual in continuing

education. Of the required continuing education of physicians, their professional organization/s are recognized by the State of Michigan as offering category one credit, which by law must account for at least fifty percent of the required continuing education credits of physicians. Category one credit is defined as attendance at professional conferences. In five out of six categories of continuing education the physician and his professional organization/s are relied upon to develop programs or individual projects to meet continuing education requirements. Only in one of six categories does the individual or professional organization appear to loose the self-directed control of continuing education activities; full-time graduate school attendance. When a physician enters full-time graduate school additional groups of individuals become involved in the process of determining what knowledge should be conveyed, how that knowledge should be conveyed, and how it will be measured as being successfully internalized. The enrollment in any graduate school places a number of restrictions upon the individual. Control over time and rate of learning are no longer in the hands of the individual but in the hands of others.

# CHAPTER III

## METHODS AND PROCEDURES

In this chapter the method of data collection, description of the population examined, and description of the analysis to be undertaken in Chapter IV are presented.

### Description of Population

The population of interest for this study is the Michigan Science Teachers Association (M.S.T.A.). as defined by the April 1989, membership list.

The M.S.T.A. is a professional organization established in 1953 to bring together all those interested in strengthening and promoting science education in Michigan. Its membership includes precollege teachers, university professors, college students, staff members of the State Board of Education, media/materials suppliers and other interested individuals.

As of April 1989, there were 2659 categorized memberships in the M.S.T.A., Table 3.1.

TABLE 3.1

M.S.T.A. Membership As of April 1989

| Category | Total |
|---|---|
| Regular Membership | 2101 |
| Family Memberships (2 Teachers) | 77 |
| School Membership | 57 |
| College Student Membership | 298 |
| Life Membership | 8 |
| Retired Membership | 15 |
| Affiliate (Exhibitors) Membership | 82 |
| PERK (Out of State) Membership | 3 |
| Unidentified Membership | 18 |
| TOTAL MEMBERSHIP | 2659 |

Description of Surveyed Population

Since it was the purpose of this study to examine and identify the level of formal and informal professional-growth activities of a particular group of science teachers (members of the M.S.T.A.) as they are conducted in practice, the survey was sent only to those in the categories identified in Table 3.2. Regular memberships which have been identified as affiliates (Exhibitor), school memberships which could include teachers with individual memberships, college students, and PERK memberships were not included in the survey. Family memberships or life memberships which

were issued to two teachers residing at the same address were sent two appropriately addressed surveys.

TABLE 3.2

Characteristics of Surveyed Population

| Category | Total |
|---|---|
| Regular Memberships | 2091 |
| Family Memberships | 154 |
| Life Memberships | 9 |
| Retired Memberships | 15 |
| Unidentified Memberships | 18 |
| TOTAL SURVEYS | 2287 |

Description of Responding Population

The survey was sent to 2287 M.S.T.A. members and a response of 1155 or 50.5 percent, was attained.

An analysis of the data indicates that the majority of the respondents are between thirty-five and forty-seven years of age and are male. A total of seventy-three percent of all respondents are under the age of forty-seven years of age, (appendix B Table B.1). Fifty-five percent of the respondents are male while forty-four percent are female, with the remainder

of one percent not responding to the question, (appendix B, Table B.2).

Sixty-three percent of the respondents indicated that they have belonged to the M.S.T.A. for three or more years. Thirty-seven percent of the respondents indicated membership of two or less years, (appendix B, Table B.3).

The largest reported category of M.S.T.A. conference attendance was that of two to five conferences, forty percent. Seven percent of the respondents, however, indicated never having attended a conference, (appendix B, Table B.4).

The respondents indicated memberships in eighty-nine other science organizations with 537 indicating membership in two or more organizations (Including the M.S.T.A.), (appendix B, Table B.5). Unfortunately, many of the responses were only abbreviations which, when compared to 1989 association references, could not be reasonably interpreted. The organizations to which ten or more respondents indicated membership were identified and are reported with respective memberships in appendix B, Table B.6. The science organization with the largest membership

was the National Science Teachers Association with 316 responses.

At present the majority of respondents have indicated that they have earned a master's degree. Only twelve percent of the respondents have indicated that they hold only a bachelor's degree, (appendix B, Table B.7).

The responses to the question of present teaching certification indicated that seventy-one percent are certified at or above the State required eighteen semester hours of continuing education, while thirteen percent have indicated only provisional certification, (appendix B, Table B.8). The remaining sixteen percent either indicated no certification or did not responded to the question.

Subject a certification in Michigan is identified by a letter code on the individual teaching certificate issued to each qualified teacher. The most common area of science certification reported by the respondents was science (DX), followed by Biology (DA), (appendix B, Table B.9). In many cases respondents indicated science certification in two or more areas while some indicated certification in only one area.

The present primary assignment of the respondents was that of teacher, which accounted for seventy-seven percent of all responses, (appendix B, Table B.10). Interestingly, while the survey instrument only listed the categories of teacher, administrator, professor, and consultant the categories of substitute, retired, and student emerged under the optional heading of other. It should be noted that the intent of the question was to identify primary assignment and that there were a number of respondents who indicated multiple assignments.

The range of the respondents' primary level of assignment was from that of preschool to university, from state consultant to museum coordinator. The majority, however, indicated that they were assigned to secondary, elementary, middle, and jr. high school positions, (appendix B, Table B.11).

The science subjects being taught by the respondents are indicated in appendix B, Table B.12. Biology appears to be the subject most often taught by the respondents while astronomy, anatomy, and advanced placement courses ( honors biology, second year chemistry, etc.) seem to be taught by the respondents on a limited basis.

The majority of the respondents, forty-one percent, teach in suburban school districts, while the fewest, nineteen percent, teach in urban school districts, (appendix B, Table B.13).

The majority of the respondents, sixty-one percent, live within twenty miles of a college or university while fifteen percent live over forty miles from a college or university, (appendix B, Table B.14).

With regard to an initial teaching assignment in the area of science, sixty-two percent of those identified as K - 12 teachers indicate a first choice while twenty-eight percent indicated second or third choice, (appendix B, Table B.15). In some cases respondents wrote on the survey that they had no choice in the matter and that they could not respond to the question in terms of the available choices.

With regard to recertification into the area of science teaching, less then three percent of the respondents identified as K - 12 teachers selected that response, (appendix B, Table B.16).

## Survey Procedures

Because there is limited information pertaining to the background, education, and actual occupation of the individual M.S.T.A. member beyond those categories identified in Table 3.1, a census survey rather than a sample survey as defined by Moser and Kalton (1972) was used in this study. To accomplish a sample survey for this study would require individual background, including educational and occupational information which would allow representative samples of appropriate size to be drawn with regard to the categories of interest (Yates, 1953; Chao, 1969; Weiss & Hassett, 1982). The identified limits further prevent the generalization of findings to the entire M.S.T.A. population using statistical methods. Even under the identified existing limits, however, a census survey still retains the essence of survey research which Butts (1983) described as being a significant way of generating knowledge of what is.

While the total cost and size of a census study is often prohibitive there are some statistical and informational benefits of conducting a census study of a population rather than a sample study. In addition, the analysis of census data would allow for the use of

relatively simple statistical techniques (Peatman, 1947).

Data Collection

A survey instrument was mailed to each individual identified in Table 3.2. Each member was encouraged to answer all questions as completely as possible and return it in a postpaid envelop.

The minimum acceptable return of surveys for analysis was 50 percent. If less than 50 percent of the surveys were returned then a second mailing to those who had not responded, identified through an examination of numbered return envelopes, was planned. The rational for setting a 50 percent return rate was based upon an examination of surveys conducted by Research Triangle Institute (R.T.I., Weiss 1987), American Institute of Physics (A.I.P, Neuschatz and Covalt 1988), the National Association of Biology Teachers (N.A.B.T., Douglas and Kahle 1983), and related literature reviewed. In both the R.T.I. and A.I.P. studies a response rate of over 70 percent of their sample was achieved. It required multiple mailings and phone contacts, however, which were accomplished by using the resources of organizations concerned with the collection of data. The survey

conducted by the N.A.B.T., however, only achieved a response rate of 50 percent of their sample with no references to multiple mailings or phone contacts but did note the limits of budget constraints of a national organization.

Survey Instrument

The survey instrument requested that the respondent answer questions in three areas; demographic information, formal professional-growth activities, and informal professional-growth activities, so as to answer the questions of the study. It also included questions pertaining to the respondent's perception of the use of knowledge gained from identified activities within their classrooms and the respondent's perceptions of obstacles to continued professional-growth activity.

The categories of questions included on the survey form are displayed in Table 3.3 together with the number of the survey question/s.

The following were the guiding questions of the study:

1. Are there differences in formal professional-growth activity of science teachers who belong to a professional organization, grouped by age or degree level?

TABLE 3.3

Survey Categories and Questions

| Categories | Survey Question/s |
|---|---|
| Age | 1 |
| Gender | 2 |
| Number of years a MSTA member | 3 |
| Other Science Organization Memberships | 4 |
| Number of MSTA Conferences attended | 5 |
| Years of Experience | 6 |
| Present Position | 10 |
| Degree and Additional Graduate Semester Hours | 7 |
| State Certification/s | 8 |
| State Certified Science Areas | 9 |
| Primary Assignment (Pre-college, College, etc.) | 11 |
| Science/s Presently Teaching | 12 |
| Change in State Certified Area | 13, 14 |
| Location of School District | 15 |
| Distance from Residence to College | 16 |
| Graduate Semester Credits Earned in Past 12 Months | 17 |
| Professional Conference Attendance in Past 12 Months | 18 |
| Attendance at School District After Work Inservices | 19 |
| Perceived Use of Knowledge Gained in Activities | 20 |
| Professional-Growth Activity Preferences | 21 |
| Obstacles to Professional Growth Activity | 22 |

2. Are there differences in informal professional-growth activity of science teachers who belong to a professional organization, grouped by age or degree level?

3. What is the relationship between formal professional-growth activity and informal professional-growth activity of teachers, grouped by age or degree level?

4. Are there differences in teacher perceptions of the relationship between knowledge gained in formal professional-growth activities and the use of such knowledge within the classroom, relative to teacher age or degree level?

5. Are there differences in teacher perceptions of the relationship between knowledge gained in informal professional-growth activities and the use of such knowledge within the classroom, relative to teacher age or degree level?

The categories of formal professional-growth activity, college courses, inservice, and conference attendance and the methodology of respective analysis are derived from a study conducted by Heitzeg (1979).

The categories of informal professional-growth activity are derived from the studies of Holly (1977), and Yovanovich (1987):

Sponsored Travel
Independent Travel
Reading Magazines/Journals
Reading Newspapers
Reading Science Related Books
Informal Gatherings of Peers
Independent Research

The categories of obstacles were derived from studies conducted by Weiss (1987) and Yovanovich (1987):

District Financial Support
Obtaining Release Time
Family/Personal Responsibilities
Travel Time to Activity
Activity Only Offered After School
Activity Only Offered on Weekends
Activity Only Offered During Summers
Relevance of Activity to Your Needs
Length of Time Needed to Complete Activity

As part of the process of designing the survey instrument it was submitted to M.S.T.A. Board Members, doctoral committee members, a selected group of practicing science teachers, and a statistician for evaluation and comments. The intent of the review process was to insure that the survey instrument was clear, asked questions appropriately, and was therefore likely to be completed so that the desired information would be obtained.

As a result of the process of instrument evaluation certain limitations were placed upon the survey instrument responses.

The responses pertaining to demographic characteristics were essentially closed-ended due to the nature of the questions and/or the needs of the study. Where it was believed clarifying information

pertaining to demographic information might be achieved, an additional response of "Other" was included.

Formal professional growth was identified as graduate college course work in terms of semester hours, attendance at professional conferences in terms of days, and after school inservice participation of the respondent in terms of hours.

The responses to combined formal and informal professional growth activity were limited to a five point scale which could be used to develop a set of tables use to compare the relative participation of age groups and degree groups in terms of mean values. The mid-point of three would indicate no change in relative participation while a number less than three would indicate an increase in relative time. And, the responses of groups could be compared for differences using the chi-square statistic.

The responses for questions pertaining to the relative use of knowledge gained in an identified formal and informal activity were limited to a three point scale for comparison. A value of one indicated a very useful activity while a value of three indicated an activity which was not useful.

The responses for questions pertaining to perceived obstacles to continued professional- growth activity were limited to a three point scale for comparison. A value of one indicated a major obstacle while a value of three indicated no effect upon a respondent's professional-growth activity.

A copy of the survey form is displayed in Appendix A.

Treatment of the Data

The responses from the returned surveys were transferred to computer disk for examination and analysis. In cases where there was no response to a particular question a code was entered indicating such.

From the responding population those respondents whose primary assignments were identified as practicing teachers at the kindergarten through the twelfth grade level of the study were identified.

The following age groups were used in the study:

22 - 34 years
35 - 47 years
48 - 65 years

The following degree groups were used in the study:

BA/BS
BA/BS + 18*
MA/MS or BA/BS + 30*
MA/MS + 15*
MA/MS + 30* or more
EdS
PhD

The formal professional-growth activity, in terms of hours, was determined for each respondent using the following conversions:

1 Semester Graduate Credit = 15 Hours
1 Term Graduate Credit = 10 Hours
1 Conference Day = 6 Hours
1 Inservice Education Day = Teacher Estimated Hours

Reports were then generated which would indicate practicing kindergarten through twelfth grade level teacher activity in each of the surveyed formal professional-growth activities with regard to the defined age groups and degree groups of the study. A mean value of response was determined for each formal professional-growth activity relative to defined age groups and degree groups.

Reports were also generated to describe the responses of age groups and degree groups with regard to relative professional-growth activity, use of knowledge obtained from participation in each activity,

and obstacles to continued professional-growth activity.

An examination of teacher participation in, perceptions of the use of, and obstacles to continued formal and informal professional-growth activities was then conducted. The formal professional-growth activities of each age and degree group were compared using the mean, standard deviation, and analysis of variance technique similar to that used by Heitzeg (1978). The relative participation in formal and informal professional growth activities within each age group and degree group were compared using the mean and the chi-square test. A difference in comparisons for each analysis was considered to be significant at an alpha level of .05.

The responses to questions pertaining to the use of knowledge attained through participation in surveyed professional-growth activities and obstacles to continued professional- growth activity were reported using tables to compare the means. It should be noted that because this study was undertaken as a census study the results of this survey will be valid only for those teachers who responded to the survey.

## Supplementary Planned Analysis

The levels of professional-growth activity with regard to the categories of age and degree were then examined with regard to gender and level of assignment (Elementary, Middle School, Jr. High, High School).

## Summary

Information pertaining to professional-growth activities of selected members of the M.S.T.A. was obtained through the use of a census survey rather than a sample survey. The information collected was used to generate information pertaining to the professional growth activities of science teachers who are members of the M.S.T.A..

The information pertaining to the professional-growth activities of science teachers who responded was used to identify an overall pattern of responses for all of the respondents using data generated in terms of means, analysis of variance, and chi-square statistics. A further analysis was undertaken to determine if there are differences in professional-growth activities relative to teacher age, degree level, gender, assignment or science specialty.

The intent of the study was to examine and identify the formal and informal professional-growth activities of a particular group of science teachers who are members of the M.S.T.A. as they are conducted in practice.

# CHAPTER IV

# DATA ANALYSIS

In this chapter the data collected pertaining to the professional-growth activities of a selected population of teachers are examined. A comparison of professional-growth activities within analysis groups is conducted with the intent of identifying levels of activity, similarities and trends. Representative respondent remarks are summarized with regard to "Other" professional-growth activities and obstacles to continued professional-growth activity and the professional-growth preferences of the population are identified. The research questions are then stated and the findings of the data analysis are related to the questions of the study.

## Formal Professional-Growth Activity Relative to the Categories of Age and Degree

The initial procedure for analysis of formal professional-growth activities required that the graduate college course semester hours and professional

conference attendance activities as reported by each respondent be converted to contact hour values. Graduate college credit hours were converted to contact hour values by multiplying semester hour units by fifteen and professional conference attendance as recorded in days of attendance was converted to contact hours by multiplying days by six. A total formal professional-growth activity value was then computed for each individual by summing the contact hours of graduate college credit, professional conference attendance, and after-hours school inservice.

Analysis of formal professional- growth activities was accomplished through the comparisons of contact hours for each identified activity and total professional-growth activity with regard to the analysis categories of age and degree.

Formal Professional-Growth Activity of Age Groups

An examination of the total formal professional-growth activities of selected age groups using an average value for each age group suggests that as the age of the respondent increases their overall professional-growth activity decreases, (Table 4.1). In particular, it is the number of graduate college credit contact hours which decreases as age increases, (Table 4.2). An examination of the responses of all

TABLE 4.1

AVERAGE CAREER EXPERIENCE AND TOTAL FORMAL PROFESSIONAL-GROWTH ACTIVITY OF SELECTED AGE GROUPS

| Group | Respondents (N) | Teaching Experience (years) | | Total* Professional Growth Hours | |
|---|---|---|---|---|---|
| | | Mean | S.D. | Mean | S.D. |
| Ages: 22 - 34 | 160 | 4.23 | 3.45 | 105.22 | 100.14 |
| Ages: 35 - 47 | 589 | 15.47 | 6.57 | 74.77 | 79.42 |
| Age: 48 - 65 | 230 | 22.72 | 8.21 | 61.04 | 59.47 |
| Age: 65 - Over | 8 | 27.00 | 9.09 | 35.63 | 23.32 |

* Total Professional Growth = ((Semester College Hours. x 15) + (Professional Conferences x 6) + After School Inservice Hours).

TABLE 4.2

FORMAL PROFESSIONAL-GROWTH ACTIVITY OF SELECTED AGE GROUPS

| Age Group (years) | Graduate Credit (semester x 15) | | Professional Conference (days x 6) | | School Inservice (hours) | |
|---|---|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| 22 - 34 | 75.18 | 89.43 | 25.05 | 28.67 | 4.99 | 1.07 |
| 35 - 47 | 36.65 | 65.27 | 30.61 | 37.00 | 7.51 | 13.16 |
| 48 - 65 | 25.26 | 46.17 | 28.33 | 30.52 | 7.45 | 13.15 |
| 65 - Over | 3.75 | 10.60 | 24.00 | 19.24 | 7.88 | 9.72 |

age groups for all formal activities using the analysis of variance indicated that there is a significant difference between age groups only with regard to total formal professional-growth activity and reported graduate activity, (Table 4.3).

Formal Professional-Growth Activity of Degree Groups

There is no clear pattern to the total formal professional-growth activity of respondents using average values with regard to degree group, (Table 4.4). There are highs and lows of activity, however, which appear at various degree groups. In particular, there are changes in graduate college activity at the degree levels of BA/BS through MA/MS + 15 which might be associated with State certification requirements and contractual benefits associated with the higher degree, (Table 4.5). An examination of the degree group responses using the analysis of variance test indicated that there is a significant difference between degree groups in total professional-growth activity and in all of the formal professional-growth activities examined, (Table 4.6).

TABLE 4.3

COMPARISON OF FORMAL PROFESSIONAL-GROWTH ACTIVITIES OF SELECTED AGE GROUPS

| Variable | Sum-of-Squares | DF | Mean-Square | F-Ratio | P |
|---|---|---|---|---|---|
| College Credit | 1182.65 | 4 | 295.66 | 15.35 | 0.000* |
| Professional Conferences | 130.52 | 4 | 32.63 | 1.00 | 0.405 |
| School Inservice | One or More Groups Has No Variance | | | | |
| Total Professional Growth | 201971.27 | 4 | 50492.82 | 8.12 | 0.000* |

Analysis of Variance is Significant if P is 0.05 or less.

TABLE 4.4

AVERAGE CAREER EXPERIENCE AND TOTAL FORMAL PROFESSIONAL-GROWTH ACTIVITY OF SELECTED DEGREE GROUPS

| Degree Group (+ hours) | Respondents (N) | Teaching Experience (years) | | Total* Professional Growth Hours | |
|---|---|---|---|---|---|
| | | Mean | S.D. | Mean | S.D. |
| BA/BS | 123 | 5.55 | 7.60 | 78.09 | 79.08 |
| BA/BS + 18 | 115 | 13.54 | 7.77 | 65.73 | 66.48 |
| BA/BA + 30 | 107 | 14.45 | 8.37 | 110.86 | 103.04 |
| MA/MS | 300 | 16.00 | 7.42 | 59.15 | 69.29 |
| MA/MS + 15 | 119 | 18.27 | 7.10 | 82.89 | 73.26 |
| MA/MS + 30 | 194 | 20.32 | 8.10 | 80.97 | 81.92 |
| EdS | 18 | 19.61 | 7.93 | 128.06 | 122.68 |
| PhD | 15 | 16.40 | 9.46 | 63.73 | 41.20 |

* Total Professional Growth = ((Semester College Hours. x 15) + (Professional Conferences x 6) + After School Inservice Hours).

TABLE 4.5

FORMAL PROFESSIONAL-GROWTH ACTIVITY OF SELECTED DEGREE GROUPS

| Degree Group (+ hours) | Graduate Credit (semester x 15) | | Professional Conference (days x 6) | | School Inservice (hours) | |
|---|---|---|---|---|---|---|
| | Mean | S.D | Mean | S.D. | Mean | S.D. |
| BA/BS | 52.19 | 67.96 | 20.95 | 21.59 | 4.96 | 9.90 |
| BA/BS + 18 | 38.09 | 62.89 | 22.90 | 18.05 | 4.74 | 9.28 |
| BA/BA + 30 | 72.90 | 99.64 | 29.13 | 34.03 | 8.83 | 13.06 |
| MA/MS | 22.71 | 50.48 | 29.94 | 34.73 | 6.50 | 11.18 |
| MA/MS + 15 | 45.83 | 59.33 | 28.63 | 33.73 | 8.44 | 15.29 |
| MA/MS + 30 | 40.06 | 71.20 | 32.66 | 35.54 | 8.24 | 15.32 |
| EdS | 47.84 | 61.68 | 69.00 | 92.90 | 11.22 | 16.30 |
| PhD | 18.00 | 35.49 | 35.40 | 26.50 | 10.33 | 12.36 |

TABLE 4.6

COMPARISON OF FORMAL PROFESSIONAL-GROWTH ACTIVITIES OF SELECTED DEGREE GROUPS

| Variable | Sum-of-Squares | DF | Mean-Square | F-Ratio | P |
|---|---|---|---|---|---|
| College Credit | 1051.04 | 7 | 150.15 | 7.71 | 0.000* |
| Professional Conferences | 1236.94 | 7 | 176.71 | 5.62 | 0.000* |
| School Inservice | 2562.12 | 7 | 366.02 | 2.30 | 0.025* |
| Total Professional Growth | 289219.43 | 7 | 41317.06 | 6.73 | 0.000* |

* Analysis of Variance is Significant at the 0.05 level.

## Participation in Professional-Growth Activities

The relative time devoted to identified informal and formal professional-growth activity was accomplished by using a five point scale. The mid-point of three indicated no relative change of professional growth activity during the past twelve months as compared to the beginning of the respondents career while a number of one or two indicated an increase and a number of four or five indicated a decrease.

## Participation of Age Groups in Professional-Growth Activities

The average values determined with regard to the relative participation in professional-growth activities of age groups suggested a similar trend in college participation as was found using respondent reported semester hours, (Table 4.7). As the age of the respondent increases the number of graduate college hours attained decreases. The only other professional-growth activity in which the use of average group values suggests a pattern with respect to age was that of sponsored travel. As the age increased a decrease in participation in sponsored travel occurs. The overall results for most categories and activities appear to be fairly close with a few exceptions which

TABLE 4.7

PARTICIPATION IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE BEGINNING OF AN AGE GROUPS TEACHING CAREER

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years | 65- Over years |
|---|---|---|---|---|
| Sponsored Travel | 3.13 * (126) | 3.25 (506) | 3.45 (195) | 4.40 (5) |
| Independent Travel | 2.69 (134) | 2.57 (541) | 2.33 (214) | 3.60 (5) |
| Reading Magazines Journals | 2.45 (137) | 2.14 (555) | 2.32 (221) | 2.60 (5) |
| Reading Newspapers | 2.55 (137) | 2.40 (552) | 2.37 (220) | 2.40 (5) |
| Reading Science Related Books | 2.39 (136) | 2.32 (555) | 2.36 (221) | 2.60 (5) |
| Informal Gatherings of Peers | 2.69 (137) | 2.61 (551) | 2.73 (219) | 3.00 (5) |
| Independent Research | 2.84 (135) | 2.98 (542) | 2.98 (212) | 4.20 (5) |
| College Classes | 2.83 (136) | 3.45 (552) | 3.65 (220) | 4.60 (5) |
| Professional Conferences | 2.26 (137) | 2.12 (551) | 2.24 (221) | 2.80 (5) |
| School Sponsored After hours, Weekend and Summer Inservices | 2.65 (127) | 2.61 (536) | 2.72 (211) | 3.25 (4) |

* Average/(Respondents). (Range of responses were from one to five. A value less than three indicates more relative time. A value greater than three indicates less relative time.)

occur at the sixty-five and over age group. In general, relative professional-growth activity is highest in the category of professional conferences and lowest in the category of sponsored travel. And, the average values of the groups suggest that relative teacher participation in most professional-growth activities is at the same or an increased level for all groups as when they first began their career. An analysis of the responses using the chi-square test indicated that there were significant differences in the categories of sponsored travel, independent travel, reading magazines and journals, informal gatherings of peers and college classes (Table 4.8). However, the significances may be considered suspect as more than twenty percent of the fitted cells had expected frequencies of less than five. Alternate Statistical procedures were explored (Borg and Gall, 1983) but the researcher was advised to use the Pearson Chi-Square test values as reported with a note of caution.

Participation of Degree Groups in Professional-Growth Activities

Relative participation in identified professional-growth activities for all degree groups using an average value to indicate group response appears to suggest that there are few differences

TABLE 4.8

COMPARISON OF PROFESSIONAL-GROWTH ACTIVITIES OF AGE GROUPS

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Sponsored Travel | 32.83 | 16 | 0.008* |
| Independent Travel | 44.68 | 16 | 0.000* |
| Reading Magazines or Journals | 30.32 | 16 | 0.016* |
| Reading Newspaper | 24.40 | 16 | 0.081 |
| Reading Science Related Books | 12.90 | 16 | 0.680 |
| Informal Gatherings of Peers | 27.16 | 16 | 0.040 |
| Independent Research | 14.42 | 16 | 0.567 |
| College Classes | 62.86 | 16 | 0.000* |
| Professional Conferences | 20.46 | 16 | 0.200 |
| School Sponsored After Hours Inservices | 15.90 | 16 | 0.460 |

* Chi-Square test is significant at the 0.05 level

between how each group rates their participation in a particular activity with the possible exception of graduate college activity, (Table 4.9). An examination of responses to college participation by degree level suggests a similar up and down level of activity as was found when the actual hours of participation in college courses was evaluated. In general, the activities of greatest relative participation for all groups are professional conferences, reading magazines and journals, and reading science-related books. And overall, with the exception of sponsored travel and college classes, the values suggested that relative teacher participation in most professional-growth activities is at the same or an increased level for all groups as when they first began their career. An analysis of the responses using the chi-square test indicated that there were significant differences in the categories of sponsored travel, independent research, college classes and professional conferences,(Table 4.10). However, the significances may be considered suspect as more than twenty percent of the fitted cells had expected frequencies of less than five.

TABLE 4.9

PARTICIPATION IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE DEGREE HELD BY K - 12 RESPONDENTS AND THE BEGINNING OF THEIR TEACHING CAREER

| Category | BA/BS * | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Sponsored Travel | 3.14 (86) | 3.18 (101) | 3.41 (87) | 3.32 (274) | 3.09 (112) | 3.34 (172) | 2.88 (17) | 3.62 (16) |
| Independent Travel | 2.57 (93) | 2.53 (106) | 2.58 (99) | 2.53 (294) | 2.62 (117) | 2.47 (188) | 2.06 (18) | 2.56 (16) |
| Reading Magazines Journals | 2.36 (99) | 2.08 (110) | 2.22 (103) | 2.24 (302) | 2.14 (118) | 2.26 (192) | 2.06 (18) | 2.25 (16) |
| Reading Newspapers | 2.46 (99) | 2.32 (108) | 2.42 (103) | 2.37 (300) | 2.51 (119) | 2.47 (191) | 2.67 (18) | 2.25 (16) |
| Reading Science Related Books | 2.28 (98) | 2.26 (110) | 2.34 (103) | 2.34 (303) | 2.36 (119) | 2.41 (190) | 2.22 (18) | 2.50 (16) |
| Informal Gatherings of Peers | 2.45 (95) | 2.74 (107) | 2.63 (103) | 2.69 (301) | 2.53 (119) | 2.71 (191) | 2.67 (18) | 2.62 (16) |
| Independent Research | 2.88 (95) | 2.95 (105) | 2.86 (101) | 3.03 (294) | 2.88 (115) | 3.01 (186) | 2.72 (18) | 2.69 (16) |
| College Classes | 3.12 (97 | 3.39 (109) | 2.85 (103) | 3.74 (299) | 3.13 (119) | 3.51 (190) | 3.44 (18) | 3.44 (16) |

TABLE 4.9 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Professional Conferences | 2.28 (98) | 2.13 (109) | 2.19 (102) | 2.16 (302) | 2.14 (119) | 2.15 (189) | 2.06 (18) | 1.88 (16) |
| School Sponsored After hours, Weekend and Summer Inservices | 2.44 (89) | 2.67 (102) | 2.45 (96) | 2.66 (285) | 2.72 (118) | 2.71 (187) | 2.61 (18) | 2.69 (16) |

* Average/(Respondents). (Range of responses were from one to five. A value less than three indicates more relative time. A value greater than three indicates less relative time.)

TABLE 4.10

COMPARISON OF PROFESSIONAL-GROWTH ACTIVITIES OF DEGREE GROUPS

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Sponsored Travel | 50.83 | 32 | 0.019* |
| Independent Travel | 39.01 | 32 | 0.184 |
| Reading Magazines or Journals | 27.53 | 32 | 0.692 |
| Reading Newspaper | 28.20 | 32 | 0.659 |
| Reading Science Related Books | 17.65 | 32 | 0.981 |
| Informal Gatherings of Peers | 27.32 | 32 | 0.702 |
| Independent Research | 47.61 | 32 | 0.037* |
| College Classes | 77.84 | 32 | 0.000* |
| Professional Conferences | 47.17 | 32 | 0.041* |
| School Sponsored After Hours Inservices | 45.68 | 32 | 0.055 |

* Chi-Square test is significant at the 0.05 level

## Use of Knowledge Generated by Participation in Professional Growth Activities

The relative use of knowledge gained from participation in an identified formal or informal professional-growth activity was examined using a three point scale. A response of one indicated a very useful activity while a value of three indicated an activity which was not useful. A fourth response was also available to indicate that the respondents had never participated in a particular activity. The fourth response was not used when an average value was computed for any activity.

## Use of Knowledge Generated by Participation in Professional-Growth Activities by Age Groups

The average responses of all age groups suggests that all of the identified activities provide useful knowledge, (Table 4.11). And there appear to be only slight differences in average values if the sixty-five and older age group is not considered. Of cular note are the average value group responses in the areas of professional conferences, reading magazines and journals, and reading science related books. A pattern of high relative knowledge use appears to be suggested through a mean comparison of roup responses in all

TABLE 4.11

USE OF KNOWLEDGE GAINED IN PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO SELECTED AGE GROUPS

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years | 65- Over years |
|---|---|---|---|---|
| Sponsored Travel | * 1.68 (76) | 1.68 (295) | 1.61 (122) | 1.50 (4) |
| Independent Travel | 1.67 (120) | 1.64 (501) | 1.67 (189) | 1.50 (6) |
| Reading Magazines Journals | 1.52 (143) | 1.45 (560) | 1.49 (218) | 1.00 (6) |
| Reading Newspapers | 1.71 (139) | 1.71 (551) | 1.76 (217) | 1.50 (6) |
| Reading Science Related Books | 1.55 (138) | 1.49 (549) | 1.53 (215) | 1.17 (6) |
| Informal Gatherings of Peers | 1.71 (131) | 1.68 (533) | 1.75 (208) | 1.50 (6) |
| Independent Research | 1.76 (100) | 1.81 (389) | 1.87 (156) | 1.80 (5) |
| College Classes | 1.67 (140) | 1.69 (537) | 1.62 (202) | 1.50 (6) |
| Professional Conferences | 1.41 (140) | 1.36 (560) | 1.34 (216) | 1.67 (6) |
| School Sponsored After hours, Weekend and Summer Inservices | 1.66 (93) | 1.76 (429) | 1.88 (179) | 1.50 (6) |

* Average/(Respondents in Category) (Range of participation responses were from one to three. A value of one indicated a very useful activity, a value of two somewhat useful, and a value of three an activity not useful.)

three. A test of significance using the chi-square test was not attempted as an examination of the raw data and consultation with a professional statistician indicated that basic assumptions for use could not be meet.

Use of Knowledge Generated by Participation in Professional-Growth Activities by Degree Groups

The average responses of all degree groups suggests that there is little difference in how each group values a particular activity with regard to the relative usefulness of knowledge gained from participation in that specific activity (Table 4.12). However, an overall generalization of the patterns of the data suggest that all groups rate the usefulness of the knowledge gained through reading magazines, reading science related books and professional conference attendance as being the most valuable. While there were slight differences in averages for each group with respect to the professional-growth activity, there were no major differences with the exception of the categories of Ed.S and Ph.D.

TABLE 4.12

USE OF THE KNOWLEDGE GAINED IN PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| | * | | | | | | | |
| Sponsored Travel | 1.75 (60) | 1.76 (46) | 1.53 (53) | 1.69 (147) | 1.68 (79) | 1.61 (114) | 1.42 (12) | 1.50 (8) |
| Independent Travel | 1.71 (92) | 1.65 (94) | 1.65 (80) | 1.67 (267) | 1.69 (110) | 1.56 (174) | 1.38 (16) | 1.86 (14) |
| Reading Magazines Journals | 1.49 (118) | 1.45 (108) | 1.47 (105) | 1.49 (298) | 1.41 (118) | 1.41 (191) | 1.56 (16) | 1.64 (14) |
| Reading Newspapers | 1.69 (113) | 1.66 (108) | 1.75 (104) | 1.73 (296) | 1.73 (117) | 1.75 (186) | 2.06 (16) | 1.71 (14) |
| Reading Science Related Books | 1.53 (110) | 1.45 (106) | 1.51 (102) | 1.51 (296) | 1.49 (118) | 1.50 (185) | 1.50 (16) | 1.40 (15) |
| Informal Gatherings of Peers | 1.69 (107) | 1.78 (98) | 1.72 (96) | 1.70 (285) | 1.73 (113) | 1.62 (184) | 1.69 (16) | 1.73 (15) |
| Independent Research | 1.78 (76) | 1.88 (69) | 1.69 (72) | 1.84 (206) | 1.82 (83) | 1.80 (143) | 1.87 (15) | 1.86 (14) |
| College Classes | 1.57 (113) | 1.79 (103) | 1.54 (96) | 1.75 (283) | 1.65 (116) | 1.66 (184) | 1.50 (16) | 1.67 (15) |

TABLE 4.12 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Professional Conferences | 1.41 (115) | 1.35 (109) | 1.35 (102) | 1.41 (298) | 1.41 (118) | 1.29 (191) | 1.19 (16) | 1.00 (14) |
| School Sponsored After hours, Weekend and Summer Inservices | 1.74 (79) | 1.72 (74) | 1.76 (71) | 1.69 (233) | 1.95 (94) | 1.84 (159) | 1.93 (15) | 1.62 (13) |

* Average/(Respondents in Category) (Range of participation responses were from one to three. A value of one indicated a very useful activity, a value of two somewhat useful, and a value of three an activity not useful.)

## Obstacles to Participation in Professional-Growth Activities

To determine how respondents viewed research-identified obstacles to continued professional-growth activity a three point scale was used. A response of one indicated that the identified obstacle was a major barrier to continued professional-growth activity. A response of two indicated that the identified obstacle was a minor obstacle to continued professional-growth activity. And a response of three indicated that the activity was not an obstacle to professional-growth activity.

### Obstacles to Participation Related to Age

In general most age groups viewed the identified categories as minor obstacles with the exception of district financial support and obtaining release time which appear to be of greater concern, (Table 4.13). If the sixty-five and over group is excluded due to its small size there is little relative difference in the overall response averages for each category with the exception of family/personal responsibilities. The age category of thirty-five to forty-seven years of age has an average value which may suggest that family/personal responsibilities is as great an obstacle to

TABLE 4.13

PERCEIVED OBSTACLES TO CONTINUED PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO SELECTED AGE GROUPS

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years | 65- Over years |
|---|---|---|---|---|
| District Financial Support | 1.62 * (143) | 1.62 (555) | 1.67 (216) | 1.67 (6) |
| Obtaining Release Time | 1.84 (145) | 1.73 (559) | 1.83 (218) | 1.60 (5) |
| Family/Personal ResponsibilitieS | 2.03 (145) | 1.77 (566) | 2.13 (216) | 2.17 (6) |
| Travel Time to Activity | 2.19 (145) | 2.09 (558) | 2.15 (217) | 2.33 (6) |
| Activity Only Offered After School | 2.28 (143) | 2.14 (557) | 2.18 (217) | 2.50 (6) |
| Activity Only Offered on Weekends | 2.12 (144) | 2.03 (558) | 2.07 (217) | 2.50 (6) |
| Activity Only Offered During Summers | 2.43 (143) | 2.20 (554) | 2.14 (218) | 2.33 (6) |

TABLE 4.13 Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years | 65- Over years |
|---|---|---|---|---|
| Relevance of Activity to Your Needs | 2.04 (137) | 1.88 (545) | 1.91 (215) | 2.33 (6) |
| Length of Time Needed to Complete Activity | 2.10 (143) | 2.00 (550) | 2.09 (216) | 2.00 (6) |

* Average/ (Respondents). (Range of responses were from one to three. A value of one indicates a major obstacle to continued professional-growth activity. A value of two indicates a minor obstacle to continued professional-growth activity. A value of three indicates no effect upon professional-growth activity.)

professional-growth activity as is obtaining release time or district financial support. A test of significance using the chi-square test was not attempted as an examination of the raw data and consultation with a professional statistician indicated that basic assumptions for use could not be meet.

## Obstacles to Participation Related to Degree

In terms of obstacles to continued professional-growth activity most degree groups viewed district financial support and obtaining release time as more than a minor obstacle, (Table 4.14). The remainder of the areas presented on the survey were identified as minor obstacles by most of the degree groups.

## Summary of Age Group and Degree Group Data Analysis

A comparison of three formal professional growth activities of selected teachers, using a contact hour value of activity, suggests that as teachers age or attain a higher level degree there are some significant differences and patterns of participation.

As teachers age there is a significant difference in total formal professional-growth activity. In particular the decrease is most apparent

TABLE 4.14

PERCEIVED OBSTACLES TO CONTINUED PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO THE DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| District Financial Support | * 1.69 (113) | 1.51 (104) | 1.51 (105) | 1.66 (295) | 1.67 (119) | 1.68 (193) | 1.80 (15) | 2.07 (14) |
| Obtaining Release Time | 1.94 (115) | 1.77 (104) | 1.76 (105) | 1.81 (295) | 1.66 (119) | 1.77 (191) | 1.75 (16) | 1.77 (13) |
| Family/Personal Responsibilities | 2.04 (117) | 1.76 (108) | 1.94 (106) | 1.78 (299) | 1.96 (120) | 1.97 (191) | 2.00 (17) | 2.13 (15) |
| Travel Time to Activity | 2.23 (114) | 2.10 (108) | 2.08 (104) | 2.06 (299) | 2.19 (118) | 2.12 (190) | 2.24 (17) | 2.20 (15) |
| Activity Only Offered After School | 2.32 (114) | 2.13 (108) | 2.17 (104) | 2.18 (296) | 2.19 (119) | 2.15 (191) | 2.25 (16) | 2.08 (13) |
| Activity Only Offered on Weekends | 2.28 (113) | 1.91 (108) | 2.09 (103) | 2.10 (299) | 2.04 (119) | 2.01 (192) | 2.06 (16) | 2.00 (14) |
| Activity Only Offered During Summers | 2.36 (111) | 2.14 (108) | 2.29 (102) | 2.23 (297) | 2.21 (120) | 2.18 (192) | 2.06 (16) | 2.14 (14) |

TABLE 4.14 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Relevance of Activity to Your Needs | 2.02 (109) | 1.97 (102) | 1.92 (101) | 1.91 (293) | 1.88 (118) | 1.87 (188) | 2.00 (16) | 1.86 (14) |
| Length of Time Needed to Complete Activity | 2.13 (108) | 1.94 (107) | 1.99 (104) | 2.05 (294) | 2.05 (118) | 2.03 (192) | 2.31 (16) | 2.14 (14) |

* Average/ (Respondents). (Range of responses were from one to three. A value of one indicates a major obstacle to continued professional-growth activity. A value of two indicates a minor obstacle to continued professional-growth activity. A value of three indicates no effect upon professional-growth activity.)

and was found to be significant only in the area of graduate college classes. In contrast, while statistical analysis indicated a significant difference between degree groups in all professional-growth activities and total formal professional-growth ctivity, there was no easily discernible pattern.

A comparison of relative time participation in identified formal and informal professional-growth activities suggests that regardless of age or degree, relative participation in most of those activities is at the same or increased level as when the teacher first entered the profession. The only activities in which there was an apparent trend, a decrease, and significance was found relative to age were graduate college courses and sponsored travel. The activities of highest relative participation which were common to age or degree analysis were, professional conferences, reading magazines or journals, and reading science-related books.

A comparison of responses with regard to the use of the knowledge gained in identified professional-growth activities found only slight differences within age group or degree group analysis. Responses of most age and degree groups suggested that all activities are useful. The activities of greatest

use were, professional conferences, reading magazines or journals, and reading science-related books.

A comparison of responses with regard to perceived obstacles to continued professional-growth activity suggested that within both age and degree groups most identified obstacles were considered as minor. Common to both analysis categories, age and degree, district financial support and obtaining release time appear to be considered as the greatest obstacles to continued professional-growth activity. And within the age group analysis categories the data suggest that the age group of thirty-five to forty-seven considers family/personal responsibilities to be as great an obstacle as obtaining district release time.

## Teacher Comments

### "Other" Professional Growth Activities of Teachers

With regard to relative participation in professional-growth activities and sources of useful knowledge, respondents were provided with the option of identifying "Other" activities which they do or would participate in beyond those identified in the survey. An examination of the responses to "Other"

professional- growth activities yielded responses in three areas, attending specific institutes or conferences, participation in professional organizations, and developing or improving their own educational materials. The institutes and conferences identified by respondents of the survey were: National Science Foundation Institutes, Edison Institutes, and Science Education in the Middle School Project. Participation in professional organizations beyond conference/workshop attendance was identified as either being a board member and/or a workshop presenter.

Teacher Identified Obstacles to Continued Professional-Growth Activity

Teacher comments pertaining to obstacles to continued professional-growth activity could be grouped in three areas, money, time, and value.

Teachers identified money as an obstacle to professional-growth activities because of the direct cost of participating in the activity; "...outrageously expensive....", "No funds for classroom innovation or labs....", "...financial cost....", "...lack of district funding....", "I don't have the money!". Or, indirect costs such as the individual working other jobs and having to pay not only for the activity but

having to lose partime employment pay; "... working weekends and summers for the past fifteen years...", "I work four different jobs to support my family!" For many respondents the issue of being able to pay for both professional growth activities and support their family was addressed in their written comments. And the data examined in this study suggest that it is a concern particularly for teachers between the ages of thirty-five and forty-seven years of age.

Time was identified as an obstacle with regard to when professional-growth activities were offered; " ...activities that take time from the teaching day...", "...time conflicts, all the activities are offered at the same time.", "...coaching duties....", "...classes are only offered during the school day....". It was also identified as affecting the need for the individual to spend time with their family or pursue personal release, " ...can't work it into my riduculously busy schedule...", "...difficult to take time from my family....", "As a beginning teacher I had more time but with a young family the focus has shifted."

Value was identified as an obstacle with regard to what participation in professional-growth activities would do for the teacher, "No science inservices, only

ones on discipline, effective schools, etc....", "Why learn how to do what you can't afford to implement, it's frustrating.", "...lack of security in keeping teaching position, fourteen pinkslips in thirteen years!", "...being overqualified when seeking employment.", "No positive effect in the classroom.", "I go on my own time, would not go if the district requested unless they paid.".

## Preferred Professional-Growth Activities of K-12 Respondents

The preferred professional-growth activities of practicing K - 12 respondents were identified by requesting that each respondent select three activities from a list of ten professional growth activities and/or add others as needed. In most cases the respondents selected three or fewer activities, while in some cases respondents added remarks indicating that they could not choose only three from the identified list. The order of preferred activities selected by all K - 12 respondents is presented in Table 4.15. Professional conferences was the number one preferred category by a significant margin followed by sponsored

TABLE 4.15

PROFESSIONAL-GROWTH ACTIVITIES IDENTIFIED BY K - 12 RESPONDENTS IN ORDER OF PREFERENCE

| Activity | Rank (Number) |
|---|---|
| Professional Conferences | 1 (735) |
| Sponsored Travel | 2 (386) |
| College Classes | 3 (382) |
| School Sponsored Activities | 4 (364) |
| Informal Gatherings of Peers | 5 (335) |
| Reading Magazines/Journals | 6 (318) |
| Independent Travel | 7 (246) |
| Reading Science Related Books | 8 (173) |
| Independent Research | 9 (132) |
| Reading Newspapers | 10 (76) |
| Other | 11 (49) |

travel, college classes, school-sponsored activities, and informal gatherings of peers.

## Supplementary Analysis

To determine if there may be an interaction between gender or level of assignment with regard to age or degree upon participation in professional-growth activities the following supplementary analysis was accomplished. The methods used to examine and identify levels of professional-growth activity or possible trends were similar to those which were used to examine the effects of age or degree upon professional-growth activities of respondents. It should be noted, however, that because of limited responses from teachers at the junior high level these responses were combined with middle school responses. The number of interacting groups needed to complete the supplementary analysis diluted many of the analysis groups to a point where caution should be used in the acceptance of the following analysis.

## Formal Professional-Growth Activities

### Formal Professional-Growth Activity of Gender/Age Groups

An examination of the total formal professional-growth hours of selected age groups with respect to gender using an average value for each group suggests that as the age of the respondent increases their overall professional-growth activity decreases, (appendix C, Table C.3). In particular, the values suggest that as an individual matures the amount of graduate college activity decreases thus leading to an apparent decrease in the total professional variable. An analysis of variance to determine if there was any difference between genders at each age grouping was found not to be significant. However, there was a significant difference found between age groups, (appendix C, Table C.4) similar to earlier findings of this study.

### Formal Professional-Growth Activity of Gender/Degree Groups

An examination of the total formal professional-growth hours of selected degree groups with respect to gender suggests that at most degree levels females are more professionally active than are

males, (appendix C, Table C.5). In particular, the differences between genders of particular degree groups is to be found in the area of graduate college credit. Only at the PH.D level, a very small sample of the total sub-group, did the category of male exceed the average values of the category of female in terms of total formal professional-growth hours. An analysis of variance of total professional-growth activity to determine if there was any difference between genders at each degree grouping was found not to be significant. There was a significant difference found, however, with regard to an overall comparison between genders and degree groups, (appendix C, Table C.6). The significance found with regard to degree is similar to earlier findings of this study. The significant difference found between genders with regard to total formal professional-growth activity appears to be a cumulative difference between genders which while not statistically significant at each degree level becomes significant when the entire gender populations are compared. A further examination of the data suggests that the major cause of the significant finding may be graduate college participation. In six of the eight degree groups female graduate college participation

averages were found to account for at least one third of the total formal professional-growth activity difference found between genders.

Formal Professional-Growth Activity of Level/ Age Groups

Because of the limited number of responses from teachers at the junior high school level their responses were grouped with those of the middle school responses. An examination of the total formal professional-growth hours with regard to assignment level and age suggests that there is greater activity at the elementary level than at either the middle school/junior high level or high school level, (appendix C, Table C.7). In particular, the difference between level/age groups appears to be related to the number of graduate hours. The data suggest that elementary teachers have taken more graduate college hours than either the middle/junior high school group or high school group regardless of age. At each age group of this analysis elementary teachers report having taken nearly twice as many graduate college courses as high school teachers. An analysis of variance could not be done to determine significance. An attempt to accomplish an analysis of variance yielded an error code identifying empty cells.

Formal Professional-Growth Activity of Level/Degree Groups

An examination of the total formal professional growth hours with regard to level of assignment and degree suggests that elementary teachers' total activity exceeds that of both the middle/junior high school or high school groups with an exception at the Ed.S.or Ph.D. levels, (appendix C, Table C.8). In particular, the amount of college credit taken by elementary teachers exceeds that of secondary and middle school teachers by between fifteen and forty-five contact hours. In addition, the data suggest that elementary teachers attended more after school inservices than either middle school/junior high school or high school teachers. An analysis of variance of total professional-growth activity to determine if there was any difference between levels at each degree grouping was found not to be significant. There was a significant difference found, however, with regard to an overall comparison between levels of assignment and degree groups, (appendix C, Table C.9). The significance found with regard to degree is similar to earlier findings of this study. The differences found between levels of assignment appears to be a cumulative difference between groups which while not statistically

significant at each degree level becomes so when the entire assignment level populations are compared.

## Participation in Professional-Growth Activities

### Participation of Gender/Age Groups in Professional-Growth Activities

An examination of relative participation in identified professional-growth activities for all age groups with respect to gender suggests that with the exceptions of sponsored travel and college classes participation is at the same level or at an increased level as when teachers first began their careers. In addition, the data suggest that there may be activity-related trends in professional-growth activities associated with gender and age. For example, as the age of both male and female groups increases the amount of relative time devoted to independent travel increases, or as the age of the male groups increases a decrease in informal gathering occurs as compared to similar female groups, (appendix C, Table C.10). Under advisement, a chi-square examination of the data for all age groups with regard to each gender was done rather than a comparison between genders due to data and methodology requirements. A chi-square examination of male age groups yielded significant

differences in sponsored travel, independent travel, informal gatherings of peers, and college classes. A chi-square examination of data for all female age groups yielded significant differences in independent travel, reading magazines/journals, and reading newspapers, (appendix C, Table C.11).

Participation of Gender/Degree Groups in Professional-Growth Activities

An examination of relative participation in identified professional-growth activities for all degree groups with respect to gender suggests that with the exceptions of sponsored travel and college classes participation is at the same level or at an increased level as when teachers first began their careers. There appear to be no easily noticeable trends to suggest changes in activity as the data are examined for either gender from degree group to the next higher degree group,(appendix C, Table C.12). A chi-square test yielded significant differences only for the gender of male with regard to the professional-growth activities of independent research and college classes, (appendix C, Table C.13).

Participation of Level/Age Groups in Professional-Growth Activities

An examination of relative participation in identified professional-growth activities for all age groups with respect to level of assignment suggests that with the exceptions of sponsored travel and college classes participation is at the same level or at an increased level as when teachers first began their careers. The data suggest that there may be a trend in terms of activities and age only at the high school level and the elementary level. At the high school level as age increases there appears to be a decrease in sponsored travel, independent research, and college classes and an increase in reading newspapers. At the elementary level the data appear to suggest an increase in professional conference activity as the age increases, (appendix C, Table C.14). A chi-square examination of the interaction of age and assignment level upon relative participation yielded significant differences at the high school level in sponsored travel, independent travel, and college classes; at the middle/junior high school level significant differences appeared only in professional conference attendance, and at the elementary level in college classes, (appendix C, Table C.15).

Participation of Level/Degree Groups in Professional-Growth Activities

An examination of relative participation in identified professional-growth activities for all degree groups with respect to level of assignment suggests that with the exceptions of sponsored travel and college classes participation is at the same level or at an increased level as when teachers first began their careers. There appear to be no other trends suggested by the data for any degree group with regard to the level of assignment in any of the surveyed professional-growth activities, (appendix C, Table C.16). A chi-square test found significant differences only at the secondary level with regard to college classes and professional conferences, (appendix C, Table C.17). A re-examination of the data from Table C.16 did not suggest a clearly visible pattern or trend for the significant findings of the chi-square test with regard to college classes or professional conferences.

## Use of Knowledge Generated by Participation in Professional-Growth Activities

### Use of Knowledge Generated by Participation in Professional-Growth Activities by Gender/Age Groups

The average data responses for both genders interacting with age suggests that all of the identified activities provide useful knowledge. And the data suggest that reading magazines and journals, and professional conference attendance provide the most useful knowledge for both genders as they mature, (appendix C, Table C.18).

### Use of Knowledge Generated by Participation in Professional-Growth Activities by Gender/Degree Groups

The average data responses for both genders interacting with degree suggests that all of the identified activities provide useful knowledge. While there are no easily discernible trends for either gender with regard to degree there is a visible contrast in the data for genders at all degree levels in school-sponsored activities. That is, the differences between reported values for each degree category with respect to gender are greater than one quarter of a point which makes those values a noticeable data pattern of differences, (appendix C,

Table C.19) . The data may suggest that females at all degree levels use the knowledge from school inservices more than males.

Use of Knowledge Generated by Participation in Professional-Growth Activities by Level/Age Groups

The average data responses for all levels of assignment interacting with age suggests that all of the identified activities provide useful knowledge. While there are no easily discernible trends for any of the levels examined there is a visible contrast in the data between the elementary and secondary levels for all age groups with regard to school-sponsored activities, (appendix C, Table C.20). The data suggest that teachers assigned to the elementary school value school-sponsored inservices more than high school teachers.

Use of Knowledge Generated by Participation in Professional-Growth Activities by Level/Degree Groups

The average data responses for all levels of assignment interacting with degree suggests that all of the identified activities provide useful knowledge. While there are no easily discernible trends for any of the levels examined with regard to degree there is a visible difference between levels found with regard to

school-sponsored activities. The trend is similar to that found with regard to level and age. The data suggest that teachers assigned to the elementary school value school-sponsored inservices more than high school teachers, (appendix C, Table C.21).

## Obstacles to Participation in Professional-Growth Activities

### Obstacles to Participation Related to Gender/Age Groups

An examination of the data suggests that most gender age groups viewed the identified categories as minor obstacles with the exceptions of district financial support and obtaining release time which appear to be of greater concern, (appendix C, Table C.22). There appears to be little difference in the average values generated with respect to either gender for most activities similar to the findings of this study relative to age groups.

### Obstacles to Participation Related to Gender/Degree Groups

An examination of the data suggest that most gender degree groups viewed the identified categories as minor obstacles with the exceptions of district

financial support, obtaining release time, relevance of activity to needs, and family/personal responsibilities, (appendix C, Table C.23).

Obstacles to Participation Related to Level/ Age Groups

An examination of the data with regard to assignment level and age groups suggests that most groups viewed the identified categories as minor obstacles with the exceptions of district financial support, obtaining release time, and family/personal responsibilities (appendix C, Table C.24). Of particular interest are the values of all assignment levels with regard to family/personal responsibilities and relevance of activity to needs. The values for all three levels suggest that at the age group of 35 -47 there is an increase in the perceptions of family/personal responsibilities as affecting activity in professional-growth activities. And the data suggest that there may be a pattern pertaining to relevance of an activity to an individual's needs as they mature. At the high school level relevance becomes more of a concern as an individual matures, at the middle school level it appears to be a constant minor obstacle, and at the elementary level age group of 35 - 47 it appears to be of great concern.

Obstacles to Participation Related to Level/Degree Groups

In general most assignment level degree groups viewed the identified categories as minor obstacles with the exceptions of district financial support, obtaining release time, family/personal responsibilities and relevance of activity to needs, (appendix C, Table C.25).

Summary of Gender and Assignment Level Data Analysis

As teachers age there is a significant decrease in total formal professional-growth activity regardless of gender. An examination of the data suggests that the decrease in professional-growth activity for both genders is primarily found in the area of graduate college courses. There were no significant differences found with regard to gender at each age grouping.

There were no significant differences found between genders relative to interaction between gender and degree. However, a significant difference was found between genders and degree groups. An examination of the data suggests that the differences in both cases appear to be related to activity in graduate college courses. Females appear to be more

active in graduate college courses at most degree levels than are males.

A comparison of total formal professional-growth activity of teachers using level of assignment, age categories, and degree categories suggests that elementary teachers are more active than either middle school/junior high school or high school teachers. While significance could not be determined relative to level interacting with age due to the available data and requirements of the statistical test or level interacting with degree, it was found with regard to level or degree in the supplementary analysis. An examination of the data to account for significant differences suggests that elementary teachers are more active in graduate college courses and after hours school inservices.

A comparison of relative time variables with regard to participation in identified formal and informal professional-growth activities suggests that regardless of gender or level of assignment interacting with age or degree, relative participation in most of those activities is at the same or increased level as when the teacher first entered the profession. Trends suggested by the data examination which were found to be significant were: as age increases independent

travel increases for both genders, as age increases male participation in informal gatherings, graduate college activity, and sponsored travel decreases. Trends which were suggested by data examination but were not found to be significant were: at the high school level as age increases sponsored travel, independent research, college classes, and reading newspapers decreases, while at the elementary school level as age increases professional conference attendance increases.

A comparison of responses with regard to the use of the knowledge gained in identified professional-growth activities found, in general, only slight differences within either gender or level of assignment analyses. Responses of most groups suggested that all activities are useful with professional conferences, reading magazines and journals and reading science-related books being valued above most other activities. Female and elementary teachers' responses suggest, however, that they are able to use school-sponsored activities more than high school respondents regardless of age or degree.

A comparison of responses with regard to perceived obstacles to continued professional-growth activity suggested that overall both gender and

assignment levels consider most identified obstacles as minor. The only two obstacles which the data suggest to be more than minor obstacles to most gender and level groups were district financial support and obtaining release time. In addition, the data suggest that family/personal responsibilities become more than a minor obstacle to continued professional-growth of teachers within the thirty-five to forty-seven age group.

## Findings of Data Analysis Related to the Questions of the Study

"Are there differences in formal professional-growth activity of science teachers who belong to a professional organization, grouped by teacher age or degree level?" Findings from an examination and statistical analysis of teacher responses suggest that there is a decrease in total formal professional-growth activity as teachers mature. In particular, there is a significant difference and an apparent decrease in graduate college credits. There was no clear trend or pattern, however, to relate level of degree to total formal professional-growth activity even though statistical analysis indicated significant differences

between groups for all activities and total formal professional-growth activity.

A supplemental analysis to determine if there were differences between gender or level of assignment and total formal professional-growth activity found that as teachers matured their total formal professional-growth activity decreases regardless of gender or level of assignment. The data suggest that the decrease in formal professional-growth activity occurs primarily in graduate college course participation. The decline in graduate college courses appeared, however, to be slower at the elementary level than at the high school level.

Similar to the analysis results found with regard to degree groups, a supplemental analysis of the interaction of gender or assignment level to degree held by respondents found no overall pattern of decline in total formal professional-growth activity. There was, however, a significant difference found between genders and assignment level groups. An examination of the data to account for significant differences suggests that females are more active in graduate college courses than are males and that elementary teachers are more active than high school teachers in

graduate college courses or after hours school inservice activities.

"Are there differences in informal professional-growth activity of science teachers who belong to a professional organization, grouped by teacher age or degree level?" Findings from an examination of teacher responses suggest that in most informal activities presented on the survey the informal professional-growth activity of teachers is at the same or slightly higher level regardless of age or degree held.

A supplementary analysis of teacher participation in informal professional-growth activities with regard to gender or assignment level found results similar to age and degree group findings. Both genders and all assignment level groups identified their levels of participation in most identified informal professional- growth activities as being at the same or greater levels as when they first began their career. There are, however, some significant differences and trends in informal professional-growth activity found with regard to gender or assignment level. There is a significant difference and a noted decrease in informal gatherings for males as they age.

And there appears to be an increase in professional conference attendance at the elementary school level as the respondents matured.

"What is the relationship between formal professional-growth activity and informal professional-growth activity of teachers, grouped by teacher age or degree level?" A comparison between the level of formal professional-growth activity and informal professional growth activity suggests that while there is a decrease in formal professional-growth activity informal professional-growth activity remains constant or increases as a teacher matures. The decline in formal professional-growth activity was found to occur primarily in graduate college course participation. While there was no pattern to formal professional-growth activity of teachers with regard to degree the results for informal activity were the same as those found relative to age. For all degree levels teachers reported a constant or increased informal professional-growth value in the identified activities.

The informal professional-growth activities which data suggest are the most preferred were reading of magazines or journals, professional conferences and reading science-related books.

To understand what might account for changes or differences in formal and informal professional-growth activity the survey included a question pertaining to obstacles to continued professional-growth activity. Of the research-identified obstacles to continued professional-growth activity the responses suggest that district financial support and release time are considered to be more than minor obstacles for most age groups and for all degree groups. In addition, for the age group of thirty-five to forty-seven, family/personal responsibilities also appear to be considered as more than a minor obstacle to continued professional-growth activity.

A supplemental analysis to determine if there were differences in formal and informal professional-growth activity related to gender or assignment level found that the responses were similar to those found with regard to age groups and degree groups. In addition, the same three obstacles to continued professional-growth activity found with regard to age groups and degree groups were identified by both genders and all assignment level groups.

"Are there differences in teacher perceptions of the relationship between knowledge gained in formal professional-growth activities and the use of such knowledge within the classroom, relative to teacher age or degree level?" A comparison within and between age and degree groups suggests that there is little difference in how each group values formal professional-growth activities. All of the identified activities listed on the survey were considered as useful activities.

A supplemental analysis to determine if there were any differences in teacher perceptions pertaining to the use of knowledge gained relative to gender or level of assignment found results similar to those found with regard to age or degree. In general, all of the surveyed activities were identified as providing useful knowledge. The responses of female and elementary teachers, however, suggest that they are able to use the knowledge gained from school-sponsored inservices more than high school respondents, regardless of age or degree.

"Are there differences in teacher perceptions of the relationship between knowledge gained in informal professional-growth activities and the use of such knowledge within the classroom, relative to teacher age or degree level?" An examination of the data suggested that there is little difference in how age groups, degree groups, genders or assignment level groups value informal professional-growth activities. All of the activities listed on the survey instrument were considered as sources of useful information. Professional conferences, reading of magazines or journals, and reading science-related books appear, however, to be the most useful activities.

# CHAPTER V

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

It was the purpose of this study to identify and examine the level of formal and informal professional-growth activities of a particular group of science teachers (members of the Michigan Science Teachers Association - M.S.T.A.) as these are conducted in practice and to examine the nature of relative changes of the acquisition of knowledge in one's career.

The survey was sent to 2287 M.S.T.A. members and a response of 1155 or 50.5 percent, was attained. From the total number of respondent responses only those responses which were from fulltime kindergarten through twelfth grade teaching staff were selected for analysis. Initial analyses used an averaging method to determine possible trends, differences, or similarities in response to the surveys professional-growth questions. Further analyses used either the chi-square test or the analysis of variance test, as appropriate

to determine if the computed average values were statistically significant. The level of significance for both the chi-square test and the analysis of variance test was set at 0.05.

In this chapter the findings are summarized with regard to the questions of the study and the literature reviewed in Chapter II. Also included in this chapter are implications for the development of professional-growth activities, reflections upon the methodology and the data used, and recommendations for further research.

## Summary and Discussion of Findings

With regard to the population surveyed the findings suggest that there is a decrease in identified formal professional-growth activity as teachers mature. However, the decrease appears to be more the result of a decrease in participation in graduate college courses rather then in other activities identified as formal professional-growth activity. An examination of the data and statistical evaluation of the other two formal professional-growth activities, professional conference attendance and after hours school inservice, could not determine a similar decrease in activity. The average

group values computed more often suggested that as the teacher matured they maintained their present patterns of activity or increased their level of participation in either professional conferences or after school inservices. The high value placed upon professional conferences, while different from Holly (1977), was consistent with that found in other science organization surveys such as completed by Neuschantz and Covalt (1988) and Douglass and Kahle (1983).

While the decrease in graduate college activity appears to be common for all age groups, genders, and levels of assignment there were some interesting differences and significant findings found in the supplementary analysis with regard to the rate of change and the level of assignment and gender/degree analyses. In particular, the data suggest that elementary school teachers have a higher average level of graduate college attendance at all age and degree groups than either middle/junior high school or high school teachers. While the difference in graduate college credit activity might be due to the rate of teacher replacement and the infusion of recently graduated teachers into the elementary school, a comparison of the sizes of the twenty-two to thirty-four age groups and B.A./B.S. degree groups

suggests something else may be occurring. The high school group is larger than the elementary group and yet their average total professional-growth activity, particularly graduate college activity values were visibly less.

Because the surveyed population identified college classes and school sponsored activities as a desired activity as did the research of Weiss (1987) with regard to preferred activities for all science teachers nationally, there must be something else which accounts for the differences in elementary or gender graduate college attendance.

Among the possible explanations for the apparent higher rate of graduate college participation by elementary teachers is the possibility that the present graduate college course offerings better fit the needs of the elementary teacher. Weiss (1987) found with regard to a national sample of science teachers that elementary teachers perceived their qualifications to teach science to be inadequate in contrast to the perceptions of middle school and high school science teachers who perceived they were adequately qualified.

A comparison of the roles and educational requirements to become certified at the elementary

level and high school level suggest that elementary teachers are generalists who need a basic knowledge background in a number of content areas. In contrast, high school science teachers must go beyond basic knowledge in at least one particular science content area at the expense of other content areas to become certified and qualified. It could be argued that because elementary teachers must take undergraduate classes in a wider variety of content areas, in contrast to high school teachers, that they are more willing to participate in graduate college courses to expand their knowledge background.

But the perceptions of adequacy of knowledge background may not be the only reason for the differences in college class participation between elementary and high school science teachers. It may be that because of the differences in the level of knowledge and laboratory requirements to convey specialized knowledge to high school science teachers and the size of the population to which an advanced science course would be addressed colleges and universities may not be financially able to or inclined to offer many graduate science classes for high school science teachers. Course offerings for high school science teachers may also be limited to the available

staff which a university has who can convey the desired information to those teachers in a manor and at a level which high school science teachers value. The importance of who and how knowledge is conveyed was identified by Holly (1977), as a item which would affect the attendance of teachers at workshops or seminars or in this case it could be argued graduate college courses should be included.

Another possible explanation which may account for the apparent difference in graduate college participation between elementary and high school science teachers might be the greater willingness or ability of elementary teachers to travel to the site where the course was offered. This explanation, however, is highly questionable considering the percent of high school science teachers who hold at least a master's degree in the surveyed population.

As for the significant difference in total professional-growth activity of female teachers which was found while examining the interaction between gender and degree, the data, literature reviewed and teacher comments provide no useful clues.

An examination of the level of informal professional-growth activity of this particular group

of science teachers, using the relative scale of the study, suggests that informal professional-growth activity does not decrease as a teacher matures or attains another degree. And it suggests that if one of the goals of a college education is to develop self-motivated learners, then there has been considerable success in that goal of college education.

The informal professional-growth activities found to be preferred by kindergarten through twelfth grade teachers were reading of magazines or journals, and reading science related books. The identified preference for reading concurs with what Holly (1977), Weiss (1987) and Neuschantz and Covalt (1988) found.

An identification of the obstacles to continued professional-growth activity which may affect the overall choices and level of professional-growth activity suggests that they are well known and commonly identified by most respondents regardless of age, degree, gender or assignment. Financial support and release time appear to be a universal concern of the respondents of this study and of previous studies by Yovanovich (1987), Douglas and Kahle (1983). Interestingly the same two obstacles to continuing professional-growth, money to pay for continuing education and time, are also identified in literature

pertaining to physician continuing education Mayer et. al. (1980).

Another notable obstacle to continued professional-growth activity was family/personal responsibilities. The data examined suggest that as the teacher enters the thirty-five to forty-seven year age group family/personal responsibilities become nearly as great an obstacle to professional-growth activity as financial assistance and release time. The need to pay one's bills, fulfill personal goals which may have been postponed to complete graduate college courses, and meet the needs of family members may be a significant incentive to the beginning and maturing teacher to find other more cost and time effective ways to improve or maintain their professional skills. It may also account for the conflict between the noted desire of teachers in this study to participate in college classes, the overall decreases in participation, and Holly's (1977) findings which indicated that teachers were more likely to turn to other teachers sixty-three percent of the time and to supervisors, professors/ universities or other people less then ten percent of the time.

In summary, an evaluation of the data from a select population of science teachers suggests that

there is a decrease in the total formal professional-growth activity of science teachers as they mature. The decrease in formal professional-growth activity, however, appears to be more the result of the maturing teacher electing to take fewer graduate college credits. Interestingly, while graduate college attendance activity does decrease as a science teacher matures the data suggest that they continue to seek knowledge at the same or higher activity levels as when they first entered the profession in the other two identified formal professional-growth activities. An evaluation of activity in professional conferences and participation in after school inservices for a select group of science teachers suggests at least a level of constant participation if not a trend to increased participation as a science teacher matures. The trend to participate more in professional conferences or activities offered outside of the university or sponsored outside of the university is also found with regard to the continuing education of physicians. The majority of professional-growth activity of physicians was identified by Mayer, et. al. (1980) to be conferences under the sponsorship of an approved organization or institution.

While there appears to be a shift in the type of formal professional-growth activity of science teachers as they mature, this study suggests that the levels of informal professional-growth activity remain constant or increase as a science teacher matures.

## Implications

The conditions of teachers with regard to the identified obstacles of, financial support, release time, family/personal obligations, initial salary, and available graduate college credit may account for the decrease in graduate college activity and a constant informal professional-growth activity. In particular, the present costs associated with graduate college credit and the time requirements for participation may prevent teachers from continued graduate activity while being an incentive for teachers to look to other sources for knowledge.

Because of the findings of this study with regard to the changing levels of formal and informal professional-growth activity of teachers as they mature and an acknowledgement of the value and difficulties of assessing professional-growth activity, it should be argued that both formal and informal activities should

be measured to arrive at a more realistic picture of teacher professional-growth activity. Perhaps by following the lead of the State of Michigan's Department of Licensing which regulates the continuing professional development for physicians a more accurate picture of teacher professional-growth and a future plan for continued teacher professional-growth may be achieved/developed. Continuing professional development for physicians is determined through an accumulation of time in a number of activities with graduate college credit being only one of six category areas of activity. In the other five areas of physician continuing education either a major professional organization or the individuals self-study is acknowledged.

As a step in the direction of accurately assessing the overall professional-growth activity of science teachers it is recommend that the relative time survey of this study or a similar instrument be used. While it may be questionable to use a scale which requires respondent perceptions to determine professional-growth activity it should be noted that the levels of participation in formal professional-growth activities on the relative time survey questions of this study provided similar results as to the level

of formal professional-growth activities found using contact hour values.

The advantage of using relative time values to determine teacher participation in all professional-growth activities is primarily informational, though expediency in data collection is also attained. A relative time survey of all professional growth activities could quickly inform the individual teacher, administrator, and other interested educational professionals of the annual professional-growth activities of teachers. It would also provide a document of teacher professional-growth activity in areas which at present provide no record.

## Reflections Upon Methodology

A note of caution and possible concern should be made with regard to the findings of this study and the suggested implications. The population surveyed is one in which it should be expected to find a high rate of professional-growth activity because the individuals already demonstrate a willingness to expend time and resources to participate.

In general, the findings of this study suggest at least a constant rate of professional-growth activity in most formal and all informal professional-growth activities. However, due to the methodology to measure formal professional-growth activity in terms of contact hours, even this select population appears to be less active in total formal professional-growth as they mature due to a decrease in accumulated graduate college credits.

Perhaps the use of contact hours which assumes that there is a positive relationship between time enrolled in a formal professional-growth activity and the assimilation of knowledge should be reconsidered or at least mediated. Although the literature suggests that time is an important variable with regard to the assimilation of knowledge the selective use of time as a measure does not necessarily or accurately measure the involvement of the individual or their gain in useful knowledge. Holly (1977), Youatt (1983), and Yovanovich (1987) have all argued that there are many other sources of useful knowledge beyond graduate credit contact hours which are not as formal and are less time consuming. Unfortunately, at present there is no other way to access quickly the professional-

growth activity of science teachers without somehow relying upon some form of time measurement.

Because the focus of the study was to describe the level of formal professional growth activities using methodology similar to that of Heitzeg (1977), and to suggest the level of informal professional-growth activity in research identified activities, the question of availability of formal professional-growth activities was not asked. In particular, there was no attempt to determine the availability of graduate college courses which might have been useful to the science teacher. And there was no attempt to differentiate the primary subject of either professional conferences or after school activities. It is quite possible that the graduate college courses undertaken by respondents of this survey were done more with an intent of leaving actual classroom teaching for a position as an administrator or support position as Burden (1979) suggested. The options for teachers to advance in their careers as classroom teachers are rather limited as is the financial gain from continued graduate college activity.

## Recommendations for Further Research

As a result of the findings and conclusions of this study the following questions for further study are raised.

Because the largest decline in formal professional-growth activity was found to occur in the area of graduate college credits relative to age it is recommended that a study be undertaken to identify what graduate college courses are available and to what ends the knowledge attained is used by teachers. Burden (1979) and others have reported in their research that there are differences in the needs of the beginning teacher and those of the career phase teacher which would affect their choices of professional-growth activities. And Sanford (1988) has argued that because of the differences inherent to science content and the process skills of science there are needs specific to beginning science educators. It is suggested that further research be done to determine:

1. What graduate level college courses are presently offered to meet the needs of the beginning and the certified career phase teacher? Are they offered at times and sites which are reasonably convenient for teachers?

2. Do teachers participate in the presently offered graduate college courses to improve their skills, attain knowledge, or do they have other motives?

3. Are there graduate college courses which appear to attract teachers even after they have completed requirements for an advanced degree or teacher certification? Why are they still attractive to career phase teachers?

The literature reviewed in this study suggest that only college courses and some school inservices have proven to be successful in imparting knowledge or achieving desired change. The impact of informal professional-growth activities appears to be largely ignored because of the lack of empirical data which would readily demonstrate the effect of informal professional-growth activities upon the knowledge base or behavior of the individual teacher. The findings of this study and others reviewed, however, suggest that informal professional-growth activities are an important source of knowledge for teachers when they begin their career and increase in importance as the teacher matures regardless of degree, gender, or assignment level. The data of this study suggest that informal professional-growth activities of teachers remained constant or increase in contrast to formal professional-growth activities as teachers mature. Further research is suggested to determine:

4. Are there or can there be developed methods to measure changes which occur in teachers in response to informal professional-growth activity?

The data analyzed in this study suggest that elementary teachers participate more in after-school inservices than do teachers assigned to either the middle/junior high school or the high school levels. In addition, teacher comments of this study and others have suggested that not all teachers value district sponsored inservices. Further research should attempt to determine specifically those who would or would not benefit from district sponsored after-school inservices.

5. Are the differences in after-school inservice participation as found in this study between elementary, middle/junior high school and high school teachers only consequences of this study population?

6. Is there a relationship between why an individual choose a specific level of assignment and their own learning styles which is expressed in their value of after-school inservices?

An analysis of data of this study found that there was a significant difference in total formal professional-growth activity of teachers relative to gender. In particular, the data of this study suggest that females participate more in graduate college courses than males.

Why would there be a difference in total formal professional-growth activity relative to gender? Is the difference in formal professional-growth activity related to feelings of low self-esteem of female teachers and the need to constantly prove themselves? Do female teachers participate more in formal professional-growth activities in general or is there a relationship to assignment levels (elementary vs. high school)? Is the formal professional-growth activity difference related to the economics of traditional family life with more male teachers working second jobs? Do graduate college courses better suit the needs and learning styles of female teachers? Or were the results only consequences of this study and the population of interest? It is suggested that further research should attempt to determine:

7. Are the differences in formal professional-growth activity between genders at the assignment levels of elementary school, middle/junior high school or high school found in this study only consequences of this study?

8. What are the causes of differences in formal professional-growth activity relative to gender? Are they cultural, economic, or related structurally to the present organizational patterns of the schools themselves? If they are related to organizational pattern of schools might there be a pattern in use at present which minimizes the differences?

# APPENDIX A

# APPENDIX A

Robert A.Hyduke
13245 Dempsey Rd.
St. Charles, MI 48655

April 20, 1989

Dear Colleague:

The attached survey is being conducted with the collaboration of the Michigan Science Teachers Association. It will take about fifteen minutes to complete the survey.

The purpose of the survey is to develop a picture of the present membership of the M.S.T.A. and their professional growth activities as they are conducted in practice. It is hoped that the combination of demographic information and professional-growth activity information of practicing teachers requested by the survey will provide some direction and guidance to the development of future professional-growth activities by the M.S.T.A. and science educators.

Because this survey is about science teachers and intended to benefit science teachers I hope that you will choose to complete it and return it in the self addressed envelope. Your participation is strictly voluntary and you indicate your willingness to participate by completing and returning the survey. Be assured that any responses you provide for this survey will be used anonymously. If you have any questions on how to respond please call

Robert A. Hyduke
(517) 865 - 6913.

Thank you for the time and consideration you gave in reading this letter and examining the survey.

Look for the results in a future M.S.T.A. publication.

Sincerely,

Robert A. Hyduke

# APPENDIX A

**Teacher Professional Activity Questionnaire**
**Michigan Science Teachers Association**

PLEASE FILL IN, CIRCLE, OR CHECK THE APPROPRIATE RESPONSE

1. Age: (Circle One) a. Under 22 b. 22 - 34 c. 35 - 47
   d. 48 -65 e. 65 - Over

2. Gender: (Circle One) a. Male b. Female

3. Number of years a MSTA member: (Circle One Group)
   a. 0 - 2 b. 3 - 5 c. 6 - 10 d. 11 - 15 e. over 15

4. Other Science Organization Memberships: (Fill In)

5. Number of MSTA Conferences attended: (Circle One)
   a. None b. 1 c. 2 - 5 d. 6 - 10 e. more than 10

6. Years of Experience for each of the following which apply (Fill In)
   Teacher:____ Administrator:____ Professor:____ Consultant:____

7. Check Present Degree: (Semester Hours)

   BA/BS____ BA/BS + 18____ BA/BS + 30 or more ____
   MA/MS____ MA/MS + 15____ MA/MS + 30 or more ____
   EdS____ PhD____ None____

8. Check Present Certification/s

   None ____ Provisional____ Continuing (18 Semester hours)____
   Continuing (30 Semester hours)____ Permanent ____.
   Other (Describe)____

9. Place a check by the science areas you are certified in by the State of Michigan.

   DA Biology ____ DC Chemistry ____ DE Physics ____
   DO Astronomy ____ DX Science ____ DH Geology-Earth Science ____
   NJ Environmental Education ____ None ____

10. Check your Present Position (Primary) Assignment

    Teacher:____ Administrator:____ Professor:____ Consultant:____
    Other:____
    (Describe or Name)

# APPENDIX A

11. Check your Present (Primary) Level of Assignment

Preschool:___ Elementary:___ Middle___ Jr. High ____
Secondary:___ Jr. College:____ College:_____ University:____
Other:_____
(Describe or Name)

12. If you teach at the middle school level or above, place a check next to the area or areas you are presently teaching.

Biology ____ Life Science _____ Ecology/Environmental _____
Physics _____ Earth Science _____ Physical Science _____
Chemistry _____ General Science _____Science Methods _____
Others (Describe)_____
_____

13. With regard to your initial teaching certificate, was teaching in the area of science your (Circle One Answer)

a. 1st choice b. 2nd choice c. 3rd choice

14. Did you recertify from a non-science area into science because of staff reductions in your district? (Circle One Answer)

a. Yes b. No

15. Which of the following best describes the location of the school district you teach in? (Circle One Answer)

a. Rural b. Suburban c. Urban

16. Which of the following best indicates a one way distance from your place of residence to a college or university. (Circle One Answer)

a. 0 - 10 miles b. 11 - 20 miles c. 21 - 30 miles
d. 31 - 40 miles e. 41 - 50 miles f. over 50 miles

17. How many graduate college credits have you earned during the past 12 months? (Fill In)

_____ term credits (quarter credits)
_____ semester credits
_____ None

18. How many days or fractions of a day have you spent attending professional educational conferences outside the school district during the past 12 months? (1 day = 6 hours of attendance). (Fill In)

_____ days

# APPENDIX A

19. If your school district offers/sponsors teacher inservice education workshops during the summer months and during the evenings and weekends during the school year answer the following.

How many hours have you participated in these kinds of activities during the past 12 months? (Do not include release time workshops offered during the regular school day.) (Fill In)

_____ (estimated hours of participation)

20. For each activity listed, circle one number to indicate the relative amount of time during the past twelve months you have devoted to that activity as compared to the time you devoted to such activities at the beginning of your career. (Circle One Number On Each Line)

| | A lot more | more | same | less | A lot less |
|---|---|---|---|---|---|
| a. Sponsored Travel: (e.g. College Credit) | 1 | 2 | 3 | 4 | 5 |
| b. Independent Travel: | 1 | 2 | 3 | 4 | 5 |
| c. Reading Magazines or Journals: | 1 | 2 | 3 | 4 | 5 |
| d. Reading Newspapers: | 1 | 2 | 3 | 4 | 5 |
| e. Reading Science Related Books: | 1 | 2 | 3 | 4 | 5 |
| f. Informal Gatherings of Peers: | 1 | 2 | 3 | 4 | 5 |
| g. Independent Research: | 1 | 2 | 3 | 4 | 5 |
| h. College Classes | 1 | 2 | 3 | 4 | 5 |
| i. Professional Conferences | 1 | 2 | 3 | 4 | 5 |
| j. School Sponsored After hours, Weekend and Summer Inservices | 1 | 2 | 3 | 4 | 5 |
| k. Other _____ (Describe) | 1 | 2 | 3 | 4 | 5 |

21. Check three of the following professional-growth activities which you would most likely participate in if offered:

___Sponsored Travel ___Independent Travel ___ College Classes

___Reading Magazines/Journals ___ Reading Newspapers

___ Reading Science Related Books ___Informal Gatherings of Peers

___Independent Research ___Professional Conferences

___School Sponsored After hours, Weekend and Summer Inservices

___Other: _____ (Describe)

# APPENDIX A

22. For each activity listed, circle the number which best describes your use of the knowledge gained from that activity in your classroom. (Circle One Number On Each Line)

| | Very Useful | Somewhat Useful | Not Useful | Never Participated In Activity |
|---|---|---|---|---|
| a. Sponsored Travel: (e.g. College Study) | 1 | 2 | 3 | 4 |
| b. Independent Travel: | 1 | 2 | 3 | 4 |
| c. Reading Magazines or Journals: | 1 | 2 | 3 | 4 |
| d. Reading Newspapers: | 1 | 2 | 3 | 4 |
| e. Reading Science Related Books: | 1 | 2 | 3 | 4 |
| f. Informal Gatherings of Peers: | 1 | 2 | 3 | 4 |
| g. Indepencent Research: | 1 | 2 | 3 | 4 |
| h. College Classes | 1 | 2 | 3 | 4 |
| i. Professional Conferences | 1 | 2 | 3 | 4 |
| j. School Sponsored After hours, Weekend and Summer Inservices | 1 | 2 | 3 | 4 |
| k. Other _____ (Describe) | 1 | 2 | 3 | 4 |

23. For each item listed, circle one number to the right of that item which best describes that item as an obstacle to your continued professional-growth activity.

| | Major Obstacle | Minor Obstacle | No Effect |
|---|---|---|---|
| a. District Financial Support | 1 | 2 | 3 |
| b. Obtaining Release Time From Teaching | 1 | 2 | 3 |
| c. Family/Personal Responsibilities | 1 | 2 | 3 |
| d. Travel Time to Activity | 1 | 2 | 3 |
| e. Activity Only Offered After School | 1 | 2 | 3 |
| f. Activity Only Offered on Weekends | 1 | 2 | 3 |
| g. Activity Only Offered During Summers | 1 | 2 | 3 |
| h. Relevance of Activity to Your Needs | 1 | 2 | 3 |
| i. Length of Time Needed to Complete Activity | 1 | 2 | 3 |
| j. Other _____ (Describe) | 1 | 2 | 3 |

PLEASE RETURN THIS SURVEY IN THE ATTACHED ENVELOPE

# APPENDIX B

# APPENDIX B

## TABLE B.1

### AGE OF MSTA RESPONDENTS

| Category | Number |
|---|---|
| Under 22 | 2 |
| 22 - 34 | 189 |
| 35 - 47 | 649 |
| 48 - 65 | 280 |
| 65 - Over | 26 |
| No Response | 9 |
| TOTAL | 1155 |

## TABLE B.2

### GENDER OF MSTA RESPONDENTS

| Gender | Number |
|---|---|
| Male | 635 |
| Female | 508 |
| No Response | 12 |
| TOTAL | 1155 |

# APPENDIX B

## TABLE B.3

### RESPONDENTS MEMBERSHIP YEARS IN MSTA

| Category | Number |
|---|---|
| 0 - 2 years | 418 |
| 3 - 5 years | 311 |
| 6 - 10 years | 153 |
| 11 - 15 years | 82 |
| Over 15 years | 176 |
| No Response | 15 |
| TOTAL | 1155 |

## TABLE B.4

### MSTA CONFERENCES ATTENDED BY RESPONDENTS

| Category | Number |
|---|---|
| None | 79 |
| 1 | 277 |
| 2 - 5 | 467 |
| 6 - 10 | 140 |
| More than 10 | 180 |
| No Response | 12 |
| TOTAL | 1155 |

# APPENDIX B

## TABLE B.5

## RESPONDENTS MEMBERSHIP IN SCIENCE ORGANIZATIONS

| Category | Number |
|---|---|
| One Organization | 618 |
| Two Organizations | 259 |
| Three Organizations | 157 |
| Four Organizations | 78 |
| Five Organizations | 28 |
| Six Organizations | 12 |
| Seven or More Organizations | 3 |
| TOTAL | 1155 |

# APPENDIX B

## TABLE B.6

### OTHER SCIENCE ORGANIZATION MEMBERSHIPS AS IDENTIFIED BY AT LEAST TEN K - 12 RESPONDENTS

| Organization | Memberships | Rank |
|---|---|---|
| National Science Teachers Association | 316 | 1 |
| National Biology Teachers Association | 81 | 2 |
| Michigan Earth Science Teachers Association | 77 | 3 |
| Metropolitan Detroit Science Teachers Association | 70 | 4 |
| Michigan Biology Teachers Association | 51 | 5 |
| American Chemical Society | 49 | 6 |
| American Association of Physics Teachers | 42 | 7 |
| Michigan Association of Science Education Specialists | 36 | 8 |
| Michigan Alliance for Environmental and Outdoor Education | 31 | 9 |
| American Association for the Advancement of Science | 25 | 10 |
| Michigan Association of Physics Teachers | 19 | 11 |
| National Earth Science Teachers Association | 18 | 12 |
| Detroit Metropolitan Area Physics Teachers Association | 12 | 13 |

# APPENDIX B

## TABLE B.7

## PRESENT DEGREE OF RESPONDENTS

| Category | Number |
|---|---|
| BA/BS | 135 |
| BA/BS + 18 | 120 |
| BA/BS + 30 or More | 115 |
| MA/MA | 323 |
| MA/MS + 15 | 131 |
| MA/MA + 30 or More | 221 |
| EdS | 24 |
| PhD | 78 |
| None | 1 |
| No Response | 7 |
| TOTAL | 1155 |

# APPENDIX B

## TABLE B.8

### PRESENT CERTIFICATION OF RESPONDENTS

| Category | Number |
|---|---|
| Provisional | 149 |
| Continuing 18 Hour | 171 |
| Continuing 30 Hour | 584 |
| Permanent | 52 |
| Other (State/etc.) | 8 |
| None | 166 |
| No Response | 25 |
| TOTAL | 1155 |

## TABLE B.9

### SCIENCE CERTIFIED AREAS OF RESPONDENTS

| Category | Number |
|---|---|
| Biology (DA) | 396 |
| Chemistry (DC) | 228 |
| Physics (DE) | 94 |
| Astronomy (DO) | 30 |
| Science (DX) | 435 |
| Geology - Earth Science (DH) | 124 |
| Environmental Education (NJ) | 67 |

# APPENDIX B

## TABLE B.10

## PRESENT POSITION OF RESPONDENTS

| Category | Number |
|---|---|
| Teacher | 894 |
| Administrator | 43 |
| Professor | 47 |
| Consultant | 27 |
| Substitute | 21 |
| Student | 8 |
| Retired | 12 |
| Other | 30 |
| Teacher and Other | 49 |
| Administrator and Other | 6 |
| Professor and Other | 5 |
| Consultant and Other | 4 |
| Student and Other | 1 |
| No Response | 8 |
| TOTAL | 1155 |

# APPENDIX B

## TABLE B.11

## PRIMARY LEVEL OF ASSIGNMENT

| Level | Number | Percent |
|---|---|---|
| Preschool | 5 | 0.4 |
| Elementary | 274 | 23.7 |
| Middle School | 163 | 14.1 |
| Jr. High | 71 | 6.1 |
| Secondary | 421 | 36.5 |
| Jr. College | 21 | 1.8 |
| College | 16 | 1.4 |
| University | 45 | 3.9 |
| Other | 47 | 4.1 |
| K - 12 | 5 | 0.4 |
| Preschool and Other | 4 | 0.3 |
| Elementary and Other | 24 | 2.1 |
| Middle School and Other | 19 | 1.6 |
| Jr. High School and Other | 11 | 1.0 |
| Secondary and Other | 7 | 0.6 |
| University and Other | 1 | 0.0 |
| No Response | 21 | 1.8 |
| TOTAL | 1155 | 99.8 % |

# APPENDIX B

## TABLE B.12

### SCIENCE SUBJECT AREA PRESENTLY TEACHING

| Subject | Number |
|---|---|
| Biology | 217 |
| Life Science | 149 |
| Ecology/Environmental | 77 |
| Physics | 110 |
| Earth Science | 164 |
| Physical Science | 173 |
| Chemistry | 183 |
| General Science | 163 |
| Astronomy | 9 |
| Science Methods | 13 |
| Other (Advanced Placement, Anatomy, etc.) | 67 |
| None (No area/s indicated) | 242 |

# APPENDIX B

## TABLE B.13

## LOCATION OF RESPONDENTS SCHOOL

| Category | Number |
|---|---|
| Rural | 402 |
| Suburban | 470 |
| Urban | 223 |
| No Response | 60 |
| TOTAL | 1155 |

## TABLE B.14

## DISTANCE FROM THE RESPONDENTS RESIDENCE TO NEAREST COLLEGE OR UNIVERSITY

| Distance | Number |
|---|---|
| 0 - 10 miles | 419 |
| 11 - 20 miles | 288 |
| 21 - 30 miles | 154 |
| 31 - 40 miles | 102 |
| 41 - 50 miles | 81 |
| Over 50 miles | 87 |
| No Response | 24 |
| TOTAL | 1155 |

# APPENDIX B

## TABLE B.15

### INITIAL TEACHING CHOICE OF K - 12 TEACHERS

| Category | Number |
|---|---|
| First Choice | 574 |
| Second Choice | 175 |
| Third Choice | 86 |
| No Response | 87 |
| TOTAL | 922 |

## TABLE B.16

### RECERTIFICATION OF K - 12 TEACHERS

| Response | Number |
|---|---|
| Yes | 23 |
| No | 822 |
| No Response | 77 |
| TOTAL | 922 |

# APPENDIX C

# APPENDIX C

## TABLE C.1

### AVERAGE CAREER EXPERIENCE AND PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO SELECTED AGE GROUPS

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (sum) | |
|---|---|---|---|---|---|
| Age: 22 - 34 years (N = 160) | | | | | |
| 4.23 | 75.18 | 25.05 | 4.99 | 105.22 | Mean |
| 3.45 | 89.43 | 28.67 | 1.07 | 100.14 | S.D. |
| Age: 35 - 47 years (N = 589) | | | | | |
| 15.47 | 36.65 | 30.61 | 7.51 | 74.77 | Mean |
| 6.57 | 65.27 | 37.00 | 13.16 | 79.42 | S.D. |
| Age: 48 - 65 years (N = 230) | | | | | |
| 22.72 | 25.26 | 28.33 | 7.45 | 61.04 | Mean |
| 8.21 | 46.17 | 30.52 | 13.15 | 59.47 | S.D. |
| Age: 65 - Over (N = 8) | | | | | |
| 27.00 | 3.75 | 24.00 | 7.88 | 35.63 | Mean |
| 9.09 | 10.60 | 19.24 | 9.72 | 23.32 | S.D. |

* Total Professional Growth = ((College Hrs. x 15) + (Professional Conferences x 6) + After School Inservices).

# APPENDIX C

## TABLE C.2

### AVERAGE CAREER EXPERIENCE AND PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO THE DEGREE HELD BY K - 12 RESPONDENTS

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| BA/BS (N = 123) | | | | | |
| 5.55 | 52.19 | 20.95 | 4.96 | 78.09 | Mean |
| 7.60 | 67.96 | 21.59 | 9.90 | 79.08 | S.D. |
| BA/BS + 18 semester hours (N = 115) | | | | | |
| 13.54 | 38.09 | 22.90 | 4.74 | 65.73 | Mean |
| 7.76 | 62.89 | 18.05 | 9.28 | 66.48 | S.D. |
| BA/BA + 30 or more semester hours (N = 107) | | | | | |
| 14.45 | 72.90 | 29.13 | 8.83 | 110.86 | Mean |
| 8.37 | 99.64 | 34.03 | 13.06 | 103.04 | S.D. |
| MA/MS (N = 300) | | | | | |
| 16.00 | 22.71 | 29.94 | 6.50 | 59.15 | Mean |
| 7.42 | 50.48 | 34.73 | 11.18 | 69.29 | S.D. |
| MA/MS + 15 (N = 119) | | | | | |
| 18.27 | 45.83 | 29.63 | 8.44 | 82.89 | Mean |
| 7.10 | 59.33 | 33.73 | 15.29 | 73.26 | S.D. |
| MA/MS + 30 or more semester hours (N = 194) | | | | | |
| 20.32 | 40.06 | 32.66 | 8.24 | 80.97 | Mean |
| 8.10 | 71.20 | 35.54 | 15.32 | 81.92 | S.D. |
| EdS (N = 18) | | | | | |
| 19.61 | 47.84 | 69.00 | 11.22 | 128.06 | Mean |
| 7.93 | 61.68 | 92.90 | 16.30 | 122.68 | S.D. |
| PhD (N = 15) | | | | | |
| 16.40 | 18.00 | 35.40 | 10.33 | 63.73 | Mean |
| 9.46 | 35.49 | 26.50 | 12.36 | 41.29 | S.D. |

* Total Professional Growth = ((College Hrs. x 15) + (Professional Conferences x 6) + After School Inservices).

# APPENDIX C

## TABLE C.3

### AVERAGE CAREER EXPERIENCE AND PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO GENDER/AGE GROUPS

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| 22 - 34 years of age | | | | | |
| Female (N = 105) | | | | | |
| 4.03 | 81.00 | 24.60 | 4.04 | 109.61 | Mean |
| 3.21 | 96.30 | 27.36 | 8.79 | 107.32 | S.D. |
| Male (N = 55) | | | | | |
| 4.71 | 63.90 | 25.92 | 6.80 | 96.83 | Mean |
| 3.86 | 74.25 | 31.26 | 12.04 | 85.08 | S.D. |
| 35 - 47 years of age | | | | | |
| Female (N = 260) | | | | | |
| 13.77 | 41.25 | 33.54 | 9.59 | 84.33 | Mean |
| 6.81 | 68.55 | 44.64 | 14.56 | 89.53 | S.D. |
| Male (N = 327) | | | | | |
| 16.78 | 33.00 | 28.32 | 5.89 | 67.23 | Mean |
| 6.06 | 62.55 | 29.52 | 11.74 | 69.76 | S.D. |

# APPENDIX C

## TABLE C.3 -Continued

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| 48 - 65 years of age | | | | | |
| Female (N = 76) | | | | | |
| 19.92 | 39.30 | 33.54 | 10.82 | 83.65 | Mean |
| 8.12 | 58.65 | 38.22 | 15.88 | 70.33 | S.D. |
| Male (N = 153) | | | | | |
| 24.05 | 18.45 | 25.68 | 5.83 | 49.97 | Mean |
| 7.93 | 36.90 | 25.68 | 11.28 | 50.05 | S.D. |

* Total Professional Growth Hours = Sum of Graduate Credit + Professional Conference + Inservice Hours.

# Appendix C

## TABLE C.4

### COMPARISON OF TOTAL FORMAL PROFESSIONAL-GROWTH ACTIVITY OF GENDER/AGE GROUPS

| Group | Sum-of-Squares | DF | Mean-Square | F-Ratio | P |
|---|---|---|---|---|---|
| Gender | 4904.34 | 1 | 4904.34 | 0.88 | 0.349 |
| Age | 156158.06 | 4 | 39039.52 | 7.00 | 0.000* |
| Gender X Age | 8891.24 | 4 | 2222.81 | 0.399 | 0.810 |

* Analysis of Variance is Significant at the 0.05 level.

# APPENDIX C

## TABLE C.5

### AVERAGE CAREER EXPERIENCE AND PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO THE GENDER AND DEGREE HELD BY K - 12 RESPONDENTS

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| BA/BS | | | | | |
| Male (N = 46) | | | | | |
| 7.87 | 44.22 | 18.46 | 4.87 | 67.54 | Mean |
| 9.41 | 70.76 | 13.68 | 10.72 | 76.49 | S.D. |
| Female (N = 70) | | | | | |
| 4.37 | 59.94 | 25.50 | 5.67 | 91.11 | Mean |
| 6.04 | 68.28 | 29.84 | 9.91 | 81.99 | S.D. |
| BA/BS + 18 semester hours | | | | | |
| Male (N = 50) | | | | | |
| 16.26 | 33.27 | 24.06 | 4.18 | 61.50 | Mean |
| 7.34 | 58.50 | 20.51 | 8.37 | 68.33 | S.D. |
| Female (N = 56) | | | | | |
| 11.40 | 46.37 | 21.48 | 4.79 | 72.62 | Mean |
| 7.39 | 68.97 | 14.58 | 8.73 | 67.79 | S.D. |

APPENDIX C

TABLE C.5 - CONTINUED

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| BA/BA + 30 or more semester hours | | | | | |
| Male (N = 38) | | | | | |
| 17.21 | 53.45 | 31.82 | 6.96 | 92.27 | Mean |
| 7.82 | 60.24 | 36.48 | 9.67 | 70.57 | S.D. |
| Female (N = 60) | | | | | |
| 13.04 | 76.55 | 27.60 | 10.43 | 114.58 | Mean |
| 8.29 | 101.62 | 29.87 | 14.79 | 106.05 | S.D. |
| MA/MS | | | | | |
| Male (N = 164) | | | | | |
| 18.36 | 15.43 | 28.15 | 5.27 | 48.87 | Mean |
| 10.02 | 36.21 | 31.60 | 9.97 | 51.50 | S.D. |
| Female (N = 12) | | | | | |
| 14.34 | 31.43 | 30.71 | 7.51 | 69.65 | Mean |
| 6.77 | 59.77 | 31.65 | 10.95 | 69.77 | S.D. |
| MA/MS + 15 | | | | | |
| Male (N = 64) | | | | | |
| 19.53 | 34.95 | 25.69 | 6.03 | 66.66 | Mean |
| 6.97 | 46.95 | 38.26 | 12.66 | 57.97 | S.D. |
| Female (N = 47) | | | | | |
| 16.97 | 54.60 | 31.51 | 11.19 | 97.30 | Mean |
| 7.22 | 69.79 | 27.97 | 18.57 | 84.71 | S.D. |

APPENDIX C

TABLE C.5 - CONTINUED

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| MA/MS + 30 or more semester hours | | | | | |
| Male (N = 133) | | | | | |
| 21.79 | 34.84 | 27.70 | 6.14 | 68.69 | Mean |
| 8.25 | 61.59 | 22.91 | 13.31 | 69.90 | S.D. |
| Female (N = 48) | | | | | |
| 16.84 | 59.66 | 42.75 | 13.15 | 115.55 | Mean |
| 6.69 | 96.57 | 55.19 | 18.89 | 106.06 | S.D. |
| EdS | | | | | |
| Male (N = 9) | | | | | |
| 18.56 | 54.33 | 44.00 | 11.67 | 110.00 | Mean |
| 7.60 | 73.77 | 23.57 | 18.71 | 82.18 | S.D. |
| Female (N = 5) | | | | | |
| 20.80 | 57.00 | 152.40 | 15.80 | 225.10 | Mean |
| 12.01 | 69.38 | 151.94 | 18.25 | 174.75 | S.D. |
| PhD | | | | | |
| Male (N = 12) | | | | | |
| 16.75 | 22.50 | 36.75 | 12.92 | 72.17 | Mean |
| 6.82 | 38.64 | 28.95 | 12.57 | 41.67 | S.D. |
| Female (N = 3) | | | | | |
| 15.00 | 0.00 | 30.00 | 0.00 | 30.00 | Mean |
| 19.16 | 0.00 | 15.88 | 0.00 | 15.86 | S.D. |

* Total Professional Growth = ((College Hrs. x 15) + (Professional Conferences x 6) + After School Inservices).

# Appendix C

## TABLE C.6

COMPARISON OF TOTAL FORMAL PROFESSIONAL-GROWTH ACTIVITY OF GENDER/DEGREE GROUPS

| Group | Sum-of-Squares | DF | Mean-Square | F-Ratio | P |
|---|---|---|---|---|---|
| Gender | 56445.67 | 1 | 56445.67 | 10.31 | 0.001* |
| Degree | 312501.59 | 7 | 44643.08 | 8.15 | 0.000* |
| Gender X Degree | 60899.54 | 7 | 8699.93 | 1.59 | 0.135 |

* Analysis of Variance is Significant at the 0.05 level.

# APPENDIX C

## TABLE C.7

### AVERAGE CAREER EXPERIENCE AND PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO ASSIGNMENT LEVEL/AGE GROUPS

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| 22 - 34 years of age | | | | | |
| Elementary (N = 46) | | | | | |
| 5.35 | 105.91 | 23.74 | 7.51 | 137.16 | Mean |
| 4.02 | 110.34 | 17.93 | 12.44 | 118.14 | S.D. |
| Middle/Jr. High (N = 39) | | | | | |
| 5.21 | 82.89 | 26.54 | 2.59 | 112.01 | Mean |
| 4.56 | 91.59 | 30.30 | 4.64 | 98.37 | S.D. |
| High School (N = 73) | | | | | |
| 4.13 | 57.27 | 25.93 | 4.88 | 88.08 | Mean |
| 3.93 | 72.71 | 33.28 | 10.82 | 85.78 | S.D. |
| 35 - 47 years of age | | | | | |
| Elementary (N = 174) | | | | | |
| 13.98 | 42.41 | 34.98 | 10.69 | 88.08 | Mean |
| 6.72 | 71.59 | 44.17 | 15.77 | 85.11 | S.D. |
| Middle/Jr. High (N = 143) | | | | | |
| 16.80 | 33.93 | 34.24 | 9.19 | 77.35 | Mean |
| 8.94 | 55.56 | 37.07 | 14.58 | 73.37 | S.D. |
| High School (N = 238) | | | | | |
| 16.81 | 28.09 | 24.65 | 4.07 | 56.82 | Mean |
| 6.91 | 49.96 | 25.36 | 7.60 | 56.96 | S.D. |

APPENDIX C

TABLE C.7 - Continued

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| 48 - 65 years of age | | | | | |
| Elementary (N = 51) | | | | | |
| 19.69 | 46.83 | 32.59 | 11.06 | 90.47 | Mean |
| 8.31 | 63.55 | 25.66 | 14.82 | 69.29 | S.D. |
| Middle/Jr. High (N = 51) | | | | | |
| 22.77 | 22.65 | 26.41 | 8.96 | 58.02 | Mean |
| 6.03 | 42.46 | 22.00 | 13.00 | 58.68 | S.D. |
| High School (N = 115) | | | | | |
| 24.55 | 19.27 | 26.79 | 5.14 | 51.20 | Mean |
| 8.45 | 37.27 | 36.02 | 12.37 | 53.17 | S.D. |

* Total Professional Growth Hours = Sum of Graduate Credit + Professional Conference + Inservice Hours.

# APPENDIX C

## TABLE C.8

### AVERAGE CAREER EXPERIENCE AND PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO THE ASSIGNMENT LEVEL AND DEGREE HELD BY K - 12 RESPONDENTS

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) |
|---|---|---|---|---|
| BA/BS | | | | |
| Secondary (N = 57) | | | | |
| 5.78 | 33.69 | 18.32 | 3.91 | 59.52 Mean |
| 8.01 | 60.12 | 16.21 | 9.68 | 65.11 S.D. |
| Middle/Jr. High (N = 20) | | | | |
| 4.75 | 66.45 | 27.91 | 2.45 | 96.65 Mean |
| 5.48 | 63.29 | 36.79 | 3.76 | 83.34 S.D. |
| Elementary (N = 39) | | | | |
| 6.24 | 71.17 | 26.54 | 9.95 | 106.64 Mean |
| 8.35 | 80.14 | 27.46 | 12.20 | 91.24 S.D. |
| BA/BS + 18 semester hours (N = 115) | | | | |
| Secondary (N = 41) | | | | |
| 15.34 | 37.73 | 20.71 | 1.88 | 60.31 Mean |
| 7.63 | 63.80 | 14.84 | 5.34 | 67.81 S.D. |
| Middle/Jr. High (N = 31) | | | | |
| 14.01 | 36.59 | 24.97 | 5.74 | 67.29 Mean |
| 8.03 | 59.20 | 14.23 | 9.02 | 59.57 S.D. |
| Elementary (N = 34) | | | | |
| 11.34 | 146.45 | 23.03 | 6.53 | 76.02 Mean |
| 7.17 | 70.98 | 22.83 | 10.41 | 75.84 S.D. |

APPENDIX C

TABLE C.8 - CONTINUED

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| BA/BA + 30 or more semester hours | | | | | |
| Secondary (N = 40) | | | | | |
| 15.55 | 52.55 | 31.65 | 5.96 | 90.16 | Mean |
| 8.69 | 64.37 | 41.89 | 10.30 | 78.37 | S.D. |
| Middle/Jr. High (N = 24) | | | | | |
| 15.79 | 59.51 | 23.00 | 9.19 | 91.69 | Mean |
| 8.81 | 77.27 | 17.21 | 12.46 | 78.70 | S.D. |
| Elementary (N = 35) | | | | | |
| 13.10 | 90.99 | 30.26 | 12.32 | 133.56 | Mean |
| 7.45 | 112.08 | 27.73 | 15.60 | 113.23 | S.D. |
| MA/MS | | | | | |
| Secondary (N = 131) | | | | | |
| 16.71 | 21.16 | 25.31 | 4.07 | 50.55 | Mean |
| 8.72 | 43.97 | 29.88 | 8.00 | 55.65 | S.D. |
| Middle/Jr. High (N = 72) | | | | | |
| 17.55 | 11.99 | 31.21 | 7.66 | 50.85 | Mean |
| 11.88 | 25.38 | 31.51 | 12.20 | 48.13 | S.D. |
| Elementary (N = 91) | | | | | |
| 15.74 | 32.37 | 33.33 | 8.20 | 73.90 | Mean |
| 6.42 | 63.39 | 33.04 | 11.49 | 72.97 | S.D. |

APPENDIX C

TABLE C.8 - CONTINUED

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) |
|---|---|---|---|---|
| MA/MS + 15 | | | | |
| Secondary (N = 53) | | | | |
| 19.84 | 39.63 | 24.09 | 4.04 | 67.75 Mean |
| 7.46 | 59.98 | 25.93 | 8.36 | 68.06 S.D. |
| Middle/Jr. High (N = 27) | | | | |
| 16.96 | 38.51 | 24.89 | 11.04 | 74.43 Mean |
| 5.91 | 38.61 | 18.80 | 21.50 | 50.54 S.D. |
| Elementary (N = 31) | | | | |
| 17.36 | 53.66 | 37.44 | 12.90 | 104.50 Mean |
| 7.40 | 46.95 | 38.26 | 17.53 | 88.04 S.D. |
| MA/MS + 30 or more semester hours | | | | |
| Secondary (N = 99) | | | | |
| 21.94 | 25.20 | 25.97 | 5.80 | 56.97 Mean |
| 8.60 | 43.65 | 23.60 | 12.14 | 51.71 S.D. |
| Middle/Jr. High (N = 49) | | | | |
| 20.63 | 56.00 | 36.00 | 6.27 | 98.26 Mean |
| 6.58 | 90.58 | 27.05 | 10.57 | 96.14 S.D. |
| Elementary (N = 35) | | | | |
| 16.36 | 66.86 | 41.57 | 16.34 | 124.77 Mean |
| 7.48 | 97.64 | 60.26 | 23.69 | 109.60 S.D. |

APPENDIX C

TABLE C.8 - CONTINUED

| Teaching Experience (years) | Graduate Credit (semester x 15) | Professional Conference (days x 6) | School Inservice (hours) | Total * Professional Growth (hours) | |
|---|---|---|---|---|---|
| EdS | | | | | |
| Secondary (N = 6) | | | | | |
| 26.33 | 26.25 | 76.50 | 9.33 | 112.08 | Mean |
| 8.04 | 41.28 | 110.17 | 20.07 | 111.71 | S.D. |
| Middle/Jr. High (N = 7) | | | | | |
| 16.71 | 84.86 | 81.86 | 19.14 | 185.86 | Mean |
| 5.31 | 75.63 | 112.93 | 16.03 | 151.65 | S.D. |
| Elementary (N = 2) | | | | | |
| 9.50 | 45.00 | 75.00 | 0.00 | 120.00 | Mean |
| 6.36 | 63.65 | 21.22 | 0.00 | 42.43 | S.D. |
| PhD | | | | | |
| Secondary (N = 5) | | | | | |
| 19.20 | 0.00 | 34.80 | 5.20 | 40.00 | Mean |
| 13.10 | 0.00 | 20.53 | 8.67 | 26.42 | S.D. |
| Middle/Jr. High (N = 6) | | | | | |
| 19.67 | 30.00 | 37.50 | 15.67 | 83.17 | Mean |
| 5.79 | 50.20 | 31.28 | 14.88 | 55.50 | S.D. |
| Elementary (N = 4) | | | | | |
| 8.00 | 22.50 | 33.00 | 8.75 | 64.25 | Mean |
| 2.16 | 28.73 | 32.68 | 11.82 | 14.06 | S.D. |

* Total Professional Growth = ((College Hrs. x 15) + (Professional Conferences x 6) + After School Inservices).

# Appendix C

## TABLE C.9

### COMPARISON OF TOTAL FORMAL PROFESSIONAL-GROWTH ACTIVITY OF ASSIGNMENT LEVEL/DEGREE GROUPS

| Group | Sum-of-Squares | DF | Mean-Square | F-Ratio | P |
|---|---|---|---|---|---|
| Level | 69181.51 | 2 | 34590.76 | 6.45 | 0.001* |
| Degree | 278103.92 | 7 | 39729.13 | 7.41 | 0.000* |
| Level X Degree | 95401.99 | 14 | 6814.43 | 1.27 | 0.219 |

* Analysis of Variance is Significant at the 0.05 level.

# APPENDIX C

## TABLE C.10

### PARTICIPATION IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO GENDER/AGE GROUPS

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Sponsored Travel | | | |
| Female | 3.24* (79) | 3.21 (211) | 3.12 (66) |
| Male | 2.94 (47) | 3.27 (295) | 3.61 (129) |
| Independent Travel | | | |
| Female | 2.57 (87) | 2.33 (230) | 2.16 (74) |
| Male | 2.89 (47) | 2.76 (311) | 2.42 (140) |
| Reading Magazines and/or Journals | | | |
| Female | 2.43 (89) | 2.09 (242) | 2.16 (75) |
| Male | 2.50 (48) | 2.17 (313) | 2.40 (146) |
| Reading Newspapers | | | |
| Female | 2.56 (89) | 2.43 (241) | 2.50 (76) |
| Male | 2.54 (48) | 2.38 (311) | 2.31 (144) |

APPENDIX C

TABLE C.10 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Reading Science Related Books | | | |
| Female | 2.40 (88) | 2.25 (241) | 2.17 (76) |
| Male | 2.38 (48) | 2.38 (314) | 2.46 (145) |
| Informal Gatherings of Peers | | | |
| Female | 2.78 (89) | 2.58 (240) | 2.64 (75) |
| Male | 2.53 (48) | 2.64 (311) | 2.78 (144) |
| Independent Research | | | |
| Female | 2.90 (87) | 2.87 (234) | 2.68 (73) |
| Male | 2.75 (48) | 3.07 (308) | 3.14 (139) |
| College Classes | | | |
| Female | 2.76 (88) | 3.27 (241) | 3.22 (75) |
| Male | 2.96 (48) | 3.59 (311) | 3.87 (145) |

APPENDIX C

TABLE C.10 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Professional Conferences | | | |
| Female | 2.19 (89) | 2.01 (239) | 1.99 (76) |
| Male | 2.38 (48) | 2.21 (312) | 2.37 (145) |
| School Sponsored After Hours, Weekend and Summer Inservices | | | |
| Female | 2.72 (82) | 2.37 (230) | 2.44 (71) |
| Male | 2.53 (45) | 2.79 (306) | 2.86 (140) |

* Average/(Respondents). (Range of responses were from one to five. A value less than three indicates more relative time. A value greater than three indicates less relative time.)

# APPENDIX C

## TABLE C.11

## COMPARISON OF PROFESSIONAL-GROWTH ACTIVITIES OF GENDER/AGE GROUPS

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Male | | | |
| Sponsored Travel | 28.23 | 12 | 0.005* |
| Independent Travel | 32.07 | 12 | 0.001* |
| Reading Magazines or Journals | 14.42 | 12 | 0.275 |
| Reading Newspaper | 6.04 | 12 | 0.914 |
| Reading Science Related Books | 10.37 | 12 | 0.584 |
| Informal Gatherings of Peers | 21.94 | 12 | 0.038* |
| Independent Research | 13.94 | 12 | 0.305 |
| College Classes | 35.22 | 12 | 0.000* |
| Professional Conferences | 12.92 | 12 | 0.375 |
| School Sponsored After Hours Inservices | 13.45 | 12 | 0.337 |

* Chi-Square test is significant at the 0.05 level

# APPENDIX C

## TABLE C.11 Continued

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Female | | | |
| Sponsored Travel | 13.97 | 16 | 0.601 |
| Independent Travel | 27.75 | 16 | 0.034* |
| Reading Magazines or Journals | 26.51 | 16 | 0.047* |
| Reading Newspaper | 26.99 | 16 | 0.042* |
| Reading Science Related Books | 12.07 | 16 | 0.739 |
| Informal Gatherings of Peers | 19.61 | 16 | 0.239 |
| Independent Research | 19.70 | 16 | 0.234 |
| College Classes | 23.19 | 16 | 0.109 |
| Professional Conferences | 18.41 | 16 | 0.300 |
| School Sponsored After Hours Inservices | 14.04 | 16 | 0.596 |

* Chi-Square test is significant at the 0.05 level

APPENDIX C

TABLE C.12

PARTICIPATION IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE GENDER AND DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Sponsored Travel * | | | | | | | | |
| Male | 3.17 (36) | 3.13 (47) | 3.49 (37) | 3.39 (157) | 3.11 (65) | 3.46 (121) | 2.73 (11) | 3.50 (12) |
| Female | 3.12 (50) | 3.22 (54) | 3.36 (50) | 3.22 (117) | 3.06 (47) | 3.06 (51) | 3.17 (6) | 3.60 (5) |
| Independent Travel | | | | | | | | |
| Male | 2.73 (37) | 2.54 (50) | 2.86 (42) | 2.77 (162) | 2.82 (66) | 2.53 (132) | 1.91 (11) | 2.50 (12) |
| Female | 2.46 (56) | 2.52 (56) | 2.37 (57) | 2.24 (132) | 2.35 (51) | 2.34 (56) | 2.29 (7) | 2.80 (5) |
| Reading Magazines and/or Journals | | | | | | | | |
| Male | 2.38 (37) | 2.18 (51) | 2.09 (44) | 2.29 (165) | 2.29 (68) | 2.32 (135) | 1.91 (11) | 2.50 (12) |
| Female | 2.35 (62) | 2.00 (59) | 2.32 (59) | 2.18 (137) | 1.94 (50) | 2.11 (57) | 2.29 (7) | 2.40 (5) |
| Reading Newspapers | | | | | | | | |
| Male | 2.46 (37) | 2.26 (50) | 2.25 (44) | 2.32 (163) | 2.53 (68) | 2.46 (134) | 2.55 (11) | 2.17 (12) |
| Female | 2.47 (62) | 2.38 (58) | 2.54 (59) | 2.44 (137) | 2.49 (51) | 2.49 (57) | 2.86 (7) | 2.20 (5) |

APPENDIX C

TABLE C.12 - CONTINUED

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Reading Science Related Books | | | | | | | | |
| Male | 2.49 (37) | 2.31 (51) | 2.36 (44) | 2.39 (166) | 2.45 (69) | 2.45 (133) | 2.18 (11) | 2.42 (12) |
| Female | 2.15 (61) | 2.22 (59) | 2.32 (59) | 2.28 (137) | 2.24 (50) | 2.32 (57) | 2.29 (7) | 2.60 (5) |
| Informal Gatherings of Peers | | | | | | | | |
| Male | 2.41 (37) | 2.87 (49) | 2.60 (44) | 2.64 (164) | 2.63 (68) | 2.75 (134) | 2.45 (11) | 2.58 (12) |
| Female | 2.48 (58) | 2.64 (58) | 2.64 (59) | 2.74 (137) | 2.39 (51) | 2.61 (57) | 3.00 (7) | 2.80 (5) |
| Independent Research | | | | | | | | |
| Male | 3.05 (37) | 3.04 (49) | 2.98 (44) | 3.15 (161) | 3.15 (65) | 3.04 (131) | 2.45 (11) | 2.42 (12) |
| Female | 2.78 (58) | 2.88 (56) | 2.77 (57) | 2.89 (133) | 2.52 (50) | 2.95 (55) | 3.14 (7) | 3.50 (4) |
| College Classes | | | | | | | | |
| Male | 3.43 (37) | 3.69 (51) | 3.00 (44) | 3.94 (164) | 3.31 (68) | 3.65 (133) | 3.36 (11) | 3.25 (12) |
| Female | 2.92 (60) | 3.12 (58) | 2.75 (59) | 3.51 (136) | 2.90 (51) | 3.16 (57) | 3.57 (7) | 4.00 (4) |

APPENDIX C

TABLE C.12 - CONTINUED

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Professional Conferences | | | | | | | | |
| Male | 2.51 (37) | 2.18 (50) | 2.23 (44) | 2.27 (166) | 2.24 (68) | 2.28 (133) | 2.00 (11) | 1.83 (12) |
| Female | 2.14 (61) | 2.08 (59) | 2.16 (58) | 2.03 (136) | 2.02 (51) | 1.86 (56) | 2.14 (7) | 2.00 (5) |
| School Sponsored After Hours, Weekend and Summer Inservices | | | | | | | | |
| Male | 2.64 (36) | 2.93 (46) | 2.52 (40) | 2.78 (160) | 2.82 (68) | 2.86 (132) | 2.73 (11) | 2.75 (12) |
| Female | 2.30 (53) | 2.45 (56) | 2.39 (56) | 2.50 (125) | 2.58 (50) | 2.36 (55) | 2.43 (7) | 2.50 (4) |

* Average/(Respondents). (Range of responses were from one to five. A value less than three indicates more relative time. A value greater than three indicates less relative time.)

# APPENDIX C

## TABLE C.13

## COMPARISON OF PROFESSIONAL-GROWTH ACTIVITIES OF GENDER/DEGREE GROUPS

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Male | | | |
| Sponsored Travel | 40.49 | 32 | 0.144 |
| Independent Travel | 38.52 | 32 | 0.198 |
| Reading Magazines or Journals | 29.99 | 32 | 0.569 |
| Reading Newspaper | 32.78 | 32 | 0.429 |
| Reading Science Related Books | 24.88 | 32 | 0.811 |
| Informal Gatherings of Peers | 31.96 | 32 | 0.469 |
| Independent Research | 70.16 | 32 | 0.000* |
| College Classes | 64.09 | 32 | 0.001* |
| Professional Conferences | 43.77 | 32 | 0.080 |
| School Sponsored After Hours Inservices | 43.52 | 32 | 0.084 |

* Chi-Square test is significant at the 0.05 level

APPENDIX C

TABLE C.13 - Continued

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Female | | | |
| Sponsored Travel | 36.28 | 28 | 0.136 |
| Independent Travel | 24.05 | 28 | 0.679 |
| Reading Magazines or Journals | 30.01 | 28 | 0.363 |
| Reading Newspaper | 16.75 | 28 | 0.953 |
| Reading Science Related Books | 22.42 | 28 | 0.762 |
| Informal Gatherings of Peers | 20.39 | 28 | 0.850 |
| Independent Research | 27.64 | 28 | 0.483 |
| College Classes | 38.65 | 28 | 0.087 |
| Professional Conferences | 35.80 | 28 | 0.148 |
| School Sponsored After Hours Inservices | 25.28 | 28 | 0.613 |

* Chi-Square test is significant at the 0.05 level

# APPENDIX C

## TABLE C.14

### PARTICIPATION IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE BEGINNING OF AN ASSIGNMENT LEVEL/AGE GROUPS TEACHING CAREER

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Sponsored Travel | | | |
| Elementary | 3.03 * (37) | 3.31 (152) | 3.05 (44) |
| Middle Jr. High | 3.43 (30) | 3.04 (141) | 3.43 (51) |
| High School | 3.03 (59) | 3.34 (213) | 3.63 (100) |
| Independent Travel | | | |
| Elementary | 2.52 (40) | 2.51 (164) | 2.14 (51) |
| Middle Jr. High | 2.68 (31) | 2.39 (148) | 2.45 (51) |
| High School | 2.79 (63) | 2.74 (229) | 2.37 (112) |
| Reading Magazines and/or Journals | | | |
| Elementary | 2.22 (41) | 2.22 (171) | 2.20 (51) |
| Middle Jr. High | 2.67 (33) | 2.04 (152) | 2.34 (53) |
| High School | 2.49 (63) | 2.13 (232) | 2.37 (117) |

APPENDIX C

TABLE C.14 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Reading Newspapers | | | |
| Elementary | 2.49 (41) | 2.44 (171) | 2.60 (52) |
| Middle Jr. High | 2.55 (33) | 2.35 (150) | 2.33 (52) |
| High School | 2.60 (63) | 2.40 (231) | 2.29 (116) |
| Reading Science Related Books | | | |
| Elementary | 2.22 (41) | 2.32 (171) | 2.23 (52) |
| Middle Jr. High | 2.47 (32) | 2.19 (151) | 2.15 (53) |
| High School | 2.46 (63) | 2.42 (233) | 2.51 (116) |
| Informal Gatherings of Peers | | | |
| Elementary | 2.66 (41) | 2.62 (170) | 2.71 (51) |
| Middle Jr. High | 2.70 (33) | 2.51 (148) | 2.73 (51) |
| High School | 2.71 (63) | 2.67 (233) | 2.74 (117) |

APPENDIX C

TABLE C.14 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Independent Research | | | |
| Elementary | 2.78 (41) | 2.96 (165) | 2.66 (50) |
| Middle Jr. High | 3.03 (32) | 2.92 (147) | 2.90 (50) |
| High School | 2.79 (62) | 3.03 (230) | 3.16 (112) |
| College Classes | | | |
| Elementary | 2.37 (41) | 3.45 (171) | 3.13 (51) |
| Middle Jr. High | 2.94 (32) | 3.34 (149) | 3.50 (52) |
| High School | 3.08 (63) | 3.52 (232) | 3.94 (117) |
| Professional Conferences | | | |
| Elementary | 2.15 (41) | 2.02 (168) | 1.84 (52) |
| Middle Jr. High | 2.45 (33) | 1.94 (151) | 2.33 (52) |
| High School | 2.22 (63) | 2.31 (232) | 2.38 (117) |

APPENDIX C

TABLE C.14 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| School Sponsored After Hours, Weekend and Summer Inservices | | | |
| Elementary | 2.45 (40) | 2.41 (164) | 2.00 (48) |
| Middle Jr. High | 3.07 (29) | 2.49 (148) | 2.74 (50) |
| High School | 2.59 (58) | 2.84 (224) | 3.01 (113) |

* Average/(Respondents). (Range of responses were from one to five. A value less than three indicates more relative time. A value greater than three indicates less relative time.)

# APPENDIX C

## TABLE C.15

## COMPARISON OF PROFESSIONAL-GROWTH ACTIVITIES OF ASSIGNMENT LEVEL/AGE GROUPS

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Elementary Level | | | |
| Sponsored Travel | 36.25 | 16 | 0.003* |
| Independent Travel | 37.92 | 16 | 0.002* |
| Reading Magazines or Journals | 25.93 | 16 | 0.055 |
| Reading Newspapers | 11.42 | 16 | 0.783 |
| Reading Science Related Books | 20.30 | 16 | 0.207 |
| Informal Gatherings of Peers | 13.11 | 16 | 0.655 |
| Independent Research | 16.40 | 16 | 0.425 |
| College Classes | 49.928 | 16 | 0.000* |
| Professional Conferences | 12.89 | 16 | 0.681 |
| School Sponsored After Hours Inservices | 17.93 | 16 | 0.328 |

* Chi-Square test is significant at the 0.05 level

APPENDIX C

TABLE C.15 - Continued

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Middle/Jr. High Level | | | |
| Sponsored Travel | 8.57 | 12 | 0.739 |
| Independent Travel | 11.35 | 12 | 0.499 |
| Reading Magazines or Journals | 7.26 | 12 | 0.840 |
| Reading Newspapers | 10.52 | 12 | 0.570 |
| Reading Science Related Books | 8.76 | 12 | 0.723 |
| Informal Gatherings of Peers | 6.95 | 12 | 0.861 |
| Independent Research | 6.85 | 12 | 0.867 |
| College Classes | 28.62 | 12 | 0.004* |
| Professional Conferences | 9.96 | 12 | 0.620 |
| School Sponsored After Hours Inservices | 9.41 | 12 | 0.668 |

* Chi-Square test is significant at the 0.05 level

APPENDIX C

TABLE C.15 - Continued

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| High School Level | | | |
| Sponsored Travel | 9.46 | 12 | 0.663 |
| Independent Travel | 18.69 | 12 | 0.096 |
| Reading Magazines or Journals | 16.804 | 12 | 0.157 |
| Reading Newspapers | 18.93 | 12 | 0.090 |
| Reading Science Related Books | 9.07 | 12 | 0.697 |
| Informal Gatherings of Peers | 12.79 | 12 | 0.384 |
| Independent Research | 11.83 | 12 | 0.460 |
| College Classes | 12.54 | 12 | 0.403 |
| Professional Conferences | 29.29 | 12 | 0.004* |
| School Sponsored After Hours Inservices | 15.47 | 12 | 0.217 |

* Chi-Square test is significant at the 0.05 level

# APPENDIX C

## TABLE C.16

PARTICIPATION IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE ASSIGNMENT LEVEL AND DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Sponsored Travel | | | | | | | | |
| Secondary | 3.34* (38) | 3.12 (41) | 3.72 (32) | 3.38 (120) | 3.16 (51) | 3.55 (84) | 2.50 (6) | 3.60 (5) |
| Elementary | 2.72 (25) | 3.10 (30) | 3.19 (31) | 3.42 (80) | 3.21 (28) | 3.09 (34) | 4.33 (3) | 3.67 (3) |
| Middle Jr. High | 3.39 (18) | 3.32 (28) | 3.18 (22) | 3.20 (65) | 3.00 (29) | 3.14 (49) | 2.71 (7) | 3.67 (6) |
| Independent Travel | | | | | | | | |
| Secondary | 2.69 (42) | 2.67 (42) | 3.03 (38) | 2.64 (127) | 2.72 (53) | 2.53 (95) | 1.86 (7) | 2.80 (5) |
| Elementary | 2.50 (26) | 2.25 (32) | 2.31 (35) | 2.49 (90) | 2.61 (31) | 2.39 (36) | 3.00 (3) | 2.33 (3) |
| Middle Jr. High | 2.67 (18) | 2.57 (30) | 2.17 (23) | 2.46 (68) | 2.45 (29) | 2.50 (52) | 2.00 (7) | 2.33 (6) |
| Reading Magazines and/or Journals | | | | | | | | |
| Secondary | 2.49 (43) | 2.19 (43) | 2.20 (41) | 2.21 (128) | 2.11 (53) | 2.37 (97) | 1.86 (7) | 3.00 (5) |
| Elementary | 2.17 (29) | 2.06 (33) | 2.25 (36) | 2.31 (93) | 2.10 (30) | 2.16 (37) | 2.67 (3) | 2.00 (3) |
| Middle Jr. High | 2.58 (19) | 2.00 (32) | 2.17 (23) | 2.27 (70) | 2.19 (31) | 2.17 (53) | 1.86 (7) | 2.00 (6) |

APPENDIX C

TABLE C.16 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Reading Newspapers | | | | | | | | |
| Secondary | 2.53 (43) | 2.40 (43) | 2.20 (41) | 2.38 (126) | 2.47 (53) | 2.47 (97) | 2.00 (7) | 2.20 (5) |
| Elementary | 2.52 (29) | 2.42 (33) | 2.72 (36) | 2.34 (93) | 2.55 (31) | 2.46 (37) | 3.00 (3) | 2.67 (3) |
| Middle Jr. High | 2.47 (19) | 2.13 (30) | 2.26 (23) | 2.36 (70) | 2.45 (31) | 2.44 (52) | 3.14 (7) | 1.83 (6) |
| Reading Science Related Books | | | | | | | | |
| Secondary | 2.33 (43) | 2.37 (43) | 2.59 (41) | 2.39 (129) | 2.44 (54) | 2.57 (95) | 2.29 (7) | 3.00 (5) |
| Elementary | 2.31 (29) | 2.30 (33) | 2.06 (36) | 2.28 (93) | 2.35 (31) | 2.30 (37) | 2.67 (3) | 3.00 (3) |
| Middle Jr. High | 2.22 (18) | 2.09 (32) | 2.30 (23) | 2.34 (70) | 2.23 (30) | 2.19 (53) | 1.71 (7) | 2.00 (6) |
| Informal Gatherings of Peers | | | | | | | | |
| Secondary | 2.42 (43) | 2.80 (43) | 2.66 (41) | 2.75 (128) | 2.76 (54) | 2.67 (97) | 2.43 (7) | 3.40 (5) |
| Elementary | 2.26 (27) | 2.73 (33) | 2.76 (36) | 2.70 (93) | 2.45 (31) | 2.73 (37) | 3.33 (3) | 2.33 (3) |
| Middle Jr. High | 2.89 (19) | 2.66 (29) | 2.30 (23) | 2.59 (69) | 2.37 (30) | 2.77 (52) | 2.43 (7) | 2.33 (6) |

APPENDIX C

TABLE C.16 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Independent Research | | | | | | | | |
| Secondary | 2.88 (42) | 2.93 (42) | 3.00 (41) | 3.10 (126) | 3.10 (53) | 3.06 (94) | 2.29 (7) | 3.80 (5) |
| Elementary | 2.74 (27) | 2.94 (33) | 2.71 (34) | 3.07 (91) | 2.57 (30) | 2.81 (36) | 3.67 (3) | 3.00 (3) |
| Middle Jr. High | 3.16 (19) | 2.93 (29) | 2.78 (23) | 2.99 (67) | 2.93 (29) | 3.06 (52) | 2.57 (7) | 2.00 (6) |
| College Classes | | | | | | | | |
| Secondary | 3.49 (43) | 3.53 (43) | 3.02 (41) | 3.90 (128) | 3.13 (54) | 3.65 (96) | 3.86 (7) | 4.40 (5) |
| Elementary | 2.60 (29) | 3.27 (33) | 2.64 (36) | 3.65 (92) | 3.00 (31) | 3.11 (37) | 4.67 (3) | 4.67 (3) |
| Middle Jr. High | 3.06 (18) | 3.26 (31) | 2.87 (23) | 3.77 (69) | 3.17 (30) | 3.40 (52) | 2.57 (7) | 2.50 (6) |
| Professional Conferences | | | | | | | | |
| Secondary | 2.30 (43) | 2.30 (43) | 2.33 (40) | 2.30 (129) | 2.35 (54) | 2.36 (96) | 2.14 (7) | 1.80 (5) |
| Elementary | 2.16 (29) | 2.12 (33) | 1.97 (36) | 1.98 (92) | 2.00 (30) | 1.83 (36) | 1.67 (3) | 2.33 (3) |
| Middle Jr. High | 2.37 (19) | 1.87 (31) | 2.13 (23) | 2.23 (70) | 1.94 (31) | 2.10 (52) | 2.14 (7) | 2.00 (6) |

APPENDIX C

TABLE C.16 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| School Sponsored After Hours, Weekend and Summer Inservices | | | | | | | | |
| Secondary | 2.64 (42) | 2.80 (41) | 2.59 (37) | 2.92 (121) | 2.98 (53) | 2.88 (94) | 2.57 (7) | 3.40 (5) |
| Elementary | 2.00 (26) | 2.29 (31) | 2.42 (36) | 2.38 (88) | 2.43 (30) | 2.23 (35) | 3.33 (3) | 3.00 (3) |
| Middle Jr. High | 2.75 (16) | 2.82 (28) | 2.23 (22) | 2.64 (67) | 2.55 (31) | 2.75 (53) | 2.29 (7) | 2.50 (6) |

* Average/(Respondents). (Range of responses were from one to five. A value less than three indicates more relative time. A value greater than three indicates less relative time.)

# APPENDIX C

## TABLE C.17

## COMPARISON OF PROFESSIONAL-GROWTH ACTIVITIES OF ASSIGNMENT LEVEL/DEGREE GROUPS

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Elementary Level | | | |
| Sponsored Travel | 37.65 | 28 | 0.105 |
| Independent Travel | 40.61 | 28 | 0.058 |
| Reading Magazines or Journals | 32.37 | 28 | 0.260 |
| Reading Newspaper | 21.90 | 28 | 0.786 |
| Reading Science Related Books | 24.52 | 28 | 0.654 |
| Informal Gatherings of Peers | 26.38 | 28 | 0.552 |
| Independent Research | 31.47 | 28 | 0.297 |
| College Classes | 50.05 | 28 | 0.006* |
| Professional Conferences | 41.48 | 28 | 0.049* |
| School Sponsored After Hours Inservices | 38.550 | 28 | 0.088 |

* Chi-Square test is significant at the 0.05 level

APPENDIX C

TABLE C.17 - Continued

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| Middle/Junior High Level | | | |
| Sponsored Travel | 37.33 | 28 | 0.112 |
| Independent Travel | 23.90 | 28 | 0.687 |
| Reading Magazines or Journals | 19.56 | 28 | 0.880 |
| Reading Newspaper | 20.84 | 28 | 0.832 |
| Reading Science Related Books | 20.29 | 28 | 0.854 |
| Informal Gatherings of Peers | 24.87 | 28 | 0.635 |
| Independent Research | 36.36 | 28 | 0.134 |
| College Classes | 31.19 | 28 | 0.309 |
| Professional Conferences | 27.10 | 28 | 0.513 |
| School Sponsored After Hours Inservices | 28.89 | 28 | 0.418 |

* Chi-Square test is significant at the 0.05 level

APPENDIX C

TABLE C.17 - Continued

| | Pearson Chi-Square Value | Degrees Freedom | Probability |
|---|---|---|---|
| High School Level | | | |
| Sponsored Travel | 33.89 | 32 | 0.377 |
| Independent Travel | 37.40 | 32 | 0.235 |
| Reading Magazines or Journals | 31.02 | 32 | 0.516 |
| Reading Newspaper | 41.27 | 32 | 0.126 |
| Reading Science Related Books | 21.67 | 32 | 0.916 |
| Informal Gatherings of Peers | 26.59 | 32 | 0.737 |
| Independent Research | 33.10 | 32 | 0.413 |
| College Classes | 47.03 | 32 | 0.042* |
| Professional Conferences | 31.89 | 32 | 0.472 |
| School Sponsored After Hours Inservices | 45.38 | 32 | 0.059 |

* Chi-Square test is significant at the 0.05 level

# APPENDIX C

## TABLE C.18

### USE OF THE KNOWLEDGE GAINED IN PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO GENDER/AGE GROUPS

| Category | 2 -34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Sponsored Travel | | | |
| Female | 1.62 (45) | 1.60 (126) | 1.48 (46) |
| Male | 1.77 (31) | 1.75 (169) | 1.68 (76) |
| Independent Travel | | | |
| Female | 1.65 (77) | 1.56 (215) | 1.53 (59) |
| Male | 1.70 (43) | 1.71 (286) | 1.74 (130) |
| Reading Magazines and/or Journals | | | |
| Female | 1.49 (92) | 1.40 (247) | 1.50 (74) |
| Male | 1.57 (51) | 1.48 (313) | 1.48 (144) |
| Reading Newspapers | | | |
| Female | 1.67 (89) | 1.70 (243) | 1.81 (72) |
| Male | 1.78 (50) | 1.73 (308) | 1.74 (145) |

APPENDIX C

TABLE C.18 - Continued

| Category | 2 -34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Reading Science Related Books | | | |
| Female | 1.56 (88) | 1.44 (240) | 1.50 (72) |
| Male | 1.54 (50) | 1.53 (309) | 1.54 (143) |
| Informal Gatherings of Peers | | | |
| Female | 1.69 (82) | 1.64 (235) | 1.75 (68) |
| Male | 1.73 (49) | 1.71 (298) | 1.74 (140) |
| Independent Research | | | |
| Female | 1.77 | 1.70 (166) | 1.76 (51) |
| Male | 1.75 (36) | 1.89 (223) | 1.92 (105) |
| College Classes | | | |
| Female | 1.63 (91) | 1.61 (239) | 1.49 (65) |
| Male | 1.76 (49) | 1.76 (298) | 1.68 (137) |

APPENDIX C

TABLE C.18 - Continued

| Category | 2 -34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Professional Conferences | | | |
| Female | 1.38 (89) | 1.30 (249) | 1.22 (72) |
| Male | 1.48 (51) | 1.41 (311) | 1.40 (144) |
| School Sponsored After Hours, Weekend and Summer Inservices | | | |
| Female | 1.61 (60) | 1.58 (191) | 1.72 (64) |
| Male | 1.76 (33) | 1.92 (238) | 1.97 (115) |

* Average/(Respondents in Category) (Range of participation responses were from one to three. A value of one indicated a very useful activity, a value of two somewhat useful, and a value of three an activity not useful.)

# APPENDIX C

## TABLE C.19

## USE OF THE KNOWLEDGE GAINED IN PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE GENDER AND DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Sponsored Travel | | | | | | | | |
| Male | 1.88* (25) | 1.85 (26) | 1.68 (22) | 1.79 (81) | 1.70 (43) | 1.65 (77) | 1.29 (7) | 1.75 (4) |
| Female | 1.66 (35) | 1.65 (20) | 1.42 (31) | 1.56 (66) | 1.67 (36) | 1.51 (37) | 1.60 (5) | 1.20 (5) |
| Independent Travel | | | | | | | | |
| Male | 1.79 (39) | 1.68 (47) | 1.75 (36) | 1.76 (146) | 1.77 (64) | 1.59 (123) | 1.44 (9) | 1.90 (10) |
| Female | 1.65 (53) | 1.62 (47) | 1.57 (44) | 1.56 (121) | 1.58 (46) | 1.51 (51) | 1.29 (7) | 1.80 (5) |
| Reading Magazines or Journals | | | | | | | | |
| Male | 1.47 (45) | 1.49 (49) | 1.55 (42) | 1.54 (164) | 1.44 (69) | 1.41 (135) | 1.56 (9) | 1.60 (10) |
| Female | 1.50 (73) | 1.42 (59) | 1.41 (63) | 1.44 (134) | 1.37 (49) | 1.41 (56) | 1.57 (7) | 1.60 (5) |
| Reading Newspapers | | | | | | | | |
| Male | 1.64 (44) | 1.72 (50) | 1.81 (42) | 1.73 (162) | 1.70 (69) | 1.76 (133) | 2.11 (9) | 1.70 (10) |
| Female | 1.70 (69) | 1.60 (58) | 1.71 (62) | 1.72 (134) | 1.77 (48) | 1.73 (53) | 2.00 (7) | 1.60 (5) |

APPENDIX C

TABLE C.19 - CONTINUED

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Reading Science Related Books | | | | | | | | |
| Male | 1.58 (43) | 1.52 (50) | 1.56 (41) | 1.58 (161) | 1.51 (70) | 1.48 (133) | 1.44 (9) | 1.36 (11) |
| Female | 1.49 (67) | 1.39 (56) | 1.48 (61) | 1.41 (135) | 1.46 (48) | 1.56 (52) | 1.57 (7) | 1.40 (5) |
| Informal Gatherings of Peers | | | | | | | | |
| Male | 1.76 (41) | 1.84 (45) | 1.68 (41) | 1.76 (160) | 1.78 (65) | 1.59 (131) | 1.78 (9) | 1.73 (11) |
| Female | 1.64 (66) | 1.72 (53) | 1.75 (55) | 1.62 (125) | 1.65 (48) | 1.70 (53) | 1.57 (7) | 1.60 (5) |
| Independent Research | | | | | | | | |
| Male | 1.74 (27) | 2.05 (38) | 1.69 (32) | 1.95 (113) | 1.95 (44) | 1.81 (104) | 2.00 (9) | 1.80 (10) |
| Female | 1.80 (49) | 1.66 (31) | 1.70 (40) | 1.71 (93) | 1.67 (39) | 1.79 (39) | 1.67 (6) | 2.00 (5) |
| College Classes | | | | | | | | |
| Male | 1.60 (42) | 1.84 (50) | 1.59 (39) | 1.84 (151) | 1.69 (67) | 1.68 (130) | 1.44 (9) | 1.64 (11) |
| Female | 1.56 (71) | 1.74 (53) | 1.51 (57) | 1.64 (132) | 1.58 (49) | 1.61 (54) | 1.57 (7) | 1.80 (5) |

APPENDIX C

TABLE C.19 - CONTINUED

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Professional Conferences | | | | | | | | |
| Male | 1.43 (45) | 1.42 (50) | 1.45 (42) | 1.49 (164) | 1.44 (68) | 1.34 (134) | 1.11 (9) | 1.00 (10) |
| Female | 1.39 (70) | 1.29 (59) | 1.28 (60) | 1.32 (134) | 1.37 (50) | 1.19 (57) | 1.29 (7) | 1.00 (5) |
| School Sponsored After Hours, Weekend and Summer Inservices | | | | | | | | |
| Male | 1.81 (32) | 2.00 (32) | 2.00 (27) | 1.85 (123) | 2.12 (56) | 1.90 (113) | 1.88 (8) | 1.60 (10) |
| Female | 1.69 (47) | 1.50 (42) | 1.61 (44) | 1.52 (110) | 1.70 (38) | 1.70 (46) | 2.00 (7) | 1.75 (4) |

* Average/(Respondents in Category) (Range of participation responses were from one to three. A value of one indicated a very useful activity, a value of two somewhat useful, and a value of three an activity not useful.)

# APPENDIX C

## TABLE C.20

### USE OF THE KNOWLEDGE GAINED IN PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO ASSIGNMENT LEVEL/AGE GROUPS

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Sponsored Travel | | | |
| Elementary | 1.70* (23) | 1.63 (95) | 1.37 (27) |
| Middle Jr. High | 1.69 (13) | 1.74 (73) | 1.67 (27) |
| High School | 1.68 (40) | 1.69 (127) | 1.68 (68) |
| Independent Travel | | | |
| Elementary | 1.66 (38) | 1.60 (154) | 1.50 (36) |
| Middle Jr. High | 1.70 (30) | 1.53 (132) | 1.61 (45) |
| High School | 1.65 (52) | 1.74 (215) | 1.75 (108) |
| Reading Magazines and/or Journals | | | |
| Elementary | 1.51 (41) | 1.46 (175) | 1.58 (50) |
| Middle Jr. High | 1.58 (33) | 1.48 (149) | 1.49 (51) |
| High School | 1.50 (69) | 1.41 (236) | 1.45 (117) |

APPENDIX C

TABLE C.20 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Reading Newspapers | | | |
| Elementary | 1.71 (41) | 1.82 (176) | 1.93 (49) |
| Middle Jr. High | 1.64 (33) | 1.68 (141) | 1.62 (50) |
| High School | 1.75 (65) | 1.65 (234) | 1.76 (118) |
| Reading Science Related Books | | | |
| Elementary | 1.56 (41) | 1.53 (173) | 1.57 (49) |
| Middle Jr. High | 1.59 (32) | 1.46 (146) | 1.47 (51) |
| High School | 1.52 (65) | 1.48 (230) | 1.53 (115) |
| Informal Gatherings of Peers | | | |
| Elementary | 1.73 (37) | 1.70 (168) | 1.82 (45) |
| Middle Jr. High | 1.68 (33) | 1.68 (139) | 1.84 (49) |
| High School | 1.70 (61) | 1.67 (226) | 1.68 (114) |

APPENDIX C

TABLE C.20 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Independent Research | | | |
| Elementary | 1.89 (28) | 1.72 (123) | 1.83 (36) |
| Middle Jr. High | 1.65 (23) | 1.82 (98) | 2.00 (36) |
| High School | 1.74 (49) | 1.88 (168) | 1.83 (84) |
| College Classes | | | |
| Elementary | 1.68 (40) | 1.69 (172) | 1.67 (43) |
| Middle Jr. High | 1.65 (34) | 1.72 (140) | 1.65 (46) |
| High School | 1.68 (66) | 1.67 (225) | 1.59 (113) |
| Professional Conferences | | | |
| Elementary | 1.30 (40) | 1.36 (178) | 1.29 (49) |
| Middle Jr. High | 1.44 (32) | 1.33 (147) | 1.34 (50) |
| High School | 1.47 (68) | 1.39 (235) | 1.36 (117) |

APPENDIX C

TABLE C.20 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| School Sponsored After Hours, Weekend and Summer Inservices | | | |
| Elementary | 1.38 (32) | 1.64 (148) | 1.56 (45) |
| Middle Jr. High | 1.76 (19) | 1.69 (113) | 1.93 (43) |
| High School | 1.83 (42) | 1.93 (168) | 2.02 (91) |

* Average/(Respondents in Category) (Range of participation responses were from one to three. A value of one indicated a very useful activity, a value of two somewhat useful, and a value of three an activity not useful.)

APPENDIX C

TABLE C.21

USE OF THE KNOWLEDGE GAINED IN SELECTED PROFESSIONAL-GROWTH ACTIVITIES RELATIVE TO THE ASSIGNMENT LEVEL AND THE DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Sponsored Travel | | | | | | | | |
| | * | | | | | | | |
| Secondary | 1.68 | 1.83 | 1.67 | 1.79 | 1.59 | 1.59 | 1.33 | 1.33 |
| | (25) | (18) | (21) | (73) | (34) | (58) | (6) | (3) |
| Elementary | 1.78 | 1.69 | 1.30 | 1.59 | 1.61 | 1.71 | 1.00 | 1.50 |
| | (18) | (13) | (20) | (44) | (23) | (24) | (2) | (2) |
| Middle Jr. High | 1.83 | 1.79 | 1.73 | 1.64 | 1.84 | 1.55 | 1.75 | 2.00 |
| | (12) | (14) | (11) | (25) | (19) | (29) | (4) | (2) |
| Independent Travel | | | | | | | | |
| Secondary | 1.72 | 1.65 | 1.81 | 1.84 | 1.81 | 1.58 | 1.57 | 1.75 |
| | (39) | (37) | (32) | (120) | (49) | (92) | (7) | (4) |
| Elementary | 1.69 | 1.69 | 1.52 | 1.55 | 1.68 | 1.55 | 1.00 | 2.00 |
| | (29) | (29) | (27) | (77) | (28) | (33) | (3) | (3) |
| Middle Jr. High | 1.72 | 1.61 | 1.60 | 1.52 | 1.48 | 1.56 | 1.33 | 2.00 |
| | (18) | (28) | (20) | (61) | (28) | (45) | (6) | (2) |
| Reading Magazines and/or Journals | | | | | | | | |
| Secondary | 1.47 | 1.40 | 1.54 | 1.47 | 1.33 | 1.36 | 1.57 | 1.50 |
| | (54) | (42) | (41) | (130) | (53) | (96) | (7) | (4) |
| Elementary | 1.51 | 1.52 | 1.46 | 1.48 | 1.43 | 1.53 | 2.00 | 1.33 |
| | (35) | (33) | (35) | (90) | (30) | (38) | (3) | (3) |
| Middle Jr. High | 1.55 | 1.48 | 1.40 | 1.54 | 1.53 | 1.44 | 1.33 | 1.83 |
| | (20) | (31) | (25) | (67) | (30) | (52) | (6) | (6) |

APPENDIX C

TABLE C.21 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Reading Newspapers | | | | | | | | |
| Secondary | 1.71 (50) | 1.52 (42) | 1.77 (40) | 1.70 (129) | 1.66 (54) | 1.72 (96) | 2.14 (7) | 1.50 (4) |
| Elementary | 1.68 (34) | 1.82 (33) | 1.81 (37) | 1.79 (90) | 1.93 (29) | 1.93 (38) | 2.67 (3) | 1.67 (3) |
| Middle Jr. High | 1.75 (20) | 1.68 (31) | 1.58 (24) | 1.67 (66) | 1.62 (29) | 1.64 (47) | 1.67 (6) | 1.80 (5) |
| Reading Science Related Books | | | | | | | | |
| Secondary | 1.51 (47) | 1.38 (42) | 1.67 (39) | 1.53 (128) | 1.46 (54) | 1.47 (94) | 1.43 (7) | 1.25 (4) |
| Elementary | 1.62 (34) | 1.50 (32) | 1.50 (36) | 1.52 (91) | 1.48 (29) | 1.67 (36) | 1.67 (3) | 1.33 (3) |
| Middle Jr. High | 1.65 (20) | 1.50 (30) | 1.33 (24) | 1.45 (66) | 1.53 (30) | 1.46 (50) | 1.50 (6) | 1.50 (6) |
| Informal Gatherings of Peers | | | | | | | | |
| Secondary | 1.65 (48) | 1.70 (40) | 1.61 (38) | 1.74 (124) | 1.73 (51) | 1.59 (94) | 1.71 (7) | 2.00 (4) |
| Elementary | 1.77 (31) | 1.76 (29) | 1.79 (33) | 1.69 (87) | 1.81 (27) | 1.63 (38) | 2.33 (3) | 1.67 (3) |
| Middle Jr. High | 1.77 (20) | 1.86 (28) | 1.74 (23) | 1.67 (64) | 1.73 (30) | 1.67 (48) | 1.33 (6) | 1.67 (6) |

APPENDIX C

TABLE C.21 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Independent Research | | | | | | | | |
| Secondary | 1.79 (33) | 1.95 (31) | 1.76 (33) | 1.87 (89) | 1.89 (38) | 1.82 (71) | 1.71 (7) | 2.00 (4) |
| Elementary | 2.00 (20) | 1.59 (17) | 1.62 (24) | 1.85 (66) | 1.57 (23) | 1.68 (31) | 2.67 (3) | 2.00 (3) |
| Middle Jr. High | 1.62 (16) | 2.00 (21) | 1.62 (13) | 1.85 (43) | 2.00 (19) | 1.87 (38) | 1.60 (5) | 1.80 (5) |
| College Classes | | | | | | | | |
| Secondary | 1.46 (50) | 1.79 (42) | 1.62 (37) | 1.80 (123) | 1.52 (53) | 1.58 (93) | 1.57 (7) | 1.75 (4) |
| Elementary | 1.68 (34) | 1.80 (30) | 1.52 (33) | 1.65 (86) | 1.77 (30) | 1.78 (37) | 1.67 (3) | 1.67 (3) |
| Middle Jr. High | 1.68 (19) | 1.79 (29) | 1.41 (22) | 1.80 (64) | 1.70 (28) | 1.69 (49) | 1.33 (6) | 1.50 (6) |
| Professional Conferences | | | | | | | | |
| Secondary | 1.45 (53) | 1.38 (42) | 1.38 (40) | 1.44 (130) | 1.43 (53) | 1.32 (96) | 1.43 (7) | 1.00 (4) |
| Elementary | 1.45 (33) | 1.39 (33) | 1.25 (36) | 1.37 (92) | 1.39 (31) | 1.21 (38) | 1.00 (3) | 1.00 (3) |
| Middle Jr. High | 1.32 (19) | 1.25 (32) | 1.48 (23) | 1.44 (66) | 1.40 (29) | 1.31 (52) | 1.00 (6) | 1.00 (6) |

APPENDIX C

TABLE C.21 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| School Sponsored After Hours, Weekend and Summer Inservices | | | | | | | | |
| Secondary | 1.91 (32) | 1.96 (27) | 2.00 (25) | 1.85 (92) | 2.11 (42) | 1.97 (78) | 1.86 (7) | 1.33 (3) |
| Elementary | 1.55 (29) | 1.62 (26) | 1.54 (26) | 1.50 (80) | 1.65 (26) | 1.68 (34) | 2.50 (2) | 1.67 (3) |
| Middle Jr. High | 1.77 (13) | 1.55 (20) | 1.75 (20) | 1.73 (52) | 1.98 (21) | 1.74 (42) | 1.83 (6) | 1.80 (5) |

* Average/(Respondents in Category) (Range of participation responses were from one to three. A value of one indicated a very useful activity, a value of two somewhat useful, and a value of three an activity not useful.)

# APPENDIX C

## TABLE C.22

## PERCEIVED OBSTACLES TO CONTINUED PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO GENDER/AGE GROUPS

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| District Financial Support * | | | |
| Female | 1.63 (91) | 1.61 (242) | 1.67 (72) |
| Male | 1.60 (52) | 1.62 (313) | 1.67 (144) |
| Obtaining Release Time | | | |
| Female | 1.81 (93) | 1.70 (243) | 1.76 (75) |
| Male | 1.88 (52) | 1.76 (316) | 1.87 (143) |
| Family/Personal Responsibilities | | | |
| Female | 2.09 (93) | 1.78 (250) | 2.20 (74) |
| Male | 1.94 (52) | 1.76 (316) | 2.09 (142) |
| Travel Time to Activity | | | |
| Female | 2.25 (93) | 2.11 (245) | 2.18 (73) |
| Male | 2.08 (52) | 2.07 (313) | 2.14 (144) |

APPENDIX C

TABLE C.22 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Activity Only Offered After School | | | |
| Female | 2.27 (92) | 2.19 (243) | 2.34 (74) |
| Male | 2.29 (51) | 2.10 (314) | 2.09 (143) |
| Activity Only Offered on Weekends | | | |
| Female | 2.13 (92) | 2.02 (243) | 2.18 (74) |
| Male | 2.10 (52) | 2.04 (315) | 2.01 (143) |
| Activity Only Offered During Summers | | | |
| Female | 2.42 (91) | 2.25 (239) | 2.33 (73) |
| Male | 2.44 (52) | 2.16 (315) | 2.04 (145) |
| Relevance of Activity to Your Needs | | | |
| Female | 2.03 (88) | 1.84 (237) | 1.83 (72) |
| Male | 2.04 (49) | 1.91 (308) | 1.96 (143) |

APPENDIX C

TABLE C.22 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Length of Time Needed to Complete Activity | | | |
| Female | 2.07 (91) | 1.97 (237) | 2.10 (73) |
| Male | 2.16 (52) | 2.01 (313) | 2.08 (143) |

* Average/ (Respondents). (Range of responses were from one to three. A value of one indicates a major obstacle to continued professional-growth activity. A value of two indicates a minor obstacle to continued professional-growth activity. A value of three indicates no effect upon professional-growth activity.)

# APPENDIX C

## TABLE C.23

## PERCEIVED OBSTACLES TO CONTINUED PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO THE GENDER AND DEGREE HELD BY K -12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| District Financial Support * | | | | | | | | |
| Male | 1.70 (46) | 1.52 (48) | 1.45 (42) | 1.63 (164) | 1.67 (69) | 1.65 (136) | 2.00 (9) | 1.91 (11) |
| Female | 1.69 (67) | 1.50 (56) | 1.56 (63) | 1.68 (131) | 1.68 (50) | 1.74 (57) | 1.50 (6) | 2.25 (4) |
| Obtaining Release Time | | | | | | | | |
| Male | 2.02 (46) | 1.90 (49) | 1.81 (42) | 1.74 (164) | 1.70 (69) | 1.81 (135) | 2.00 (10) | 1.73 (11) |
| Female | 1.89 (69) | 1.66 (59) | 1.73 (62) | 1.89 (133) | 1.62 (50) | 1.66 (56) | 1.33 (6) | 2.33 (3) |
| Family/Personal Responsibilities | | | | | | | | |
| Male | 2.07 (46) | 1.78 (49) | 1.81 (42) | 1.78 (165) | 1.86 (70) | 1.95 (133) | 2.10 (10) | 2.09 (11) |
| Female | 2.03 (71) | 1.75 (59) | 2.03 (64) | 1.78 (134) | 2.11 (50) | 2.00 (58) | 1.86 (7) | 2.20 (5) |
| Travel Time to Activity | | | | | | | | |
| Male | 2.20 (46) | 2.00 (49) | 2.14 (42) | 2.02 (165) | 2.14 (69) | 2.10 (133) | 2.30 (10) | 2.27 (11) |
| Female | 2.25 (69) | 2.19 (59) | 2.03 (62) | 2.11 (134) | 2.27 (49) | 2.18 (57) | 2.14 (7) | 2.20 (5) |

APPENDIX C

TABLE C.23 - CONTINUED

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Activity Only Offered After School | | | | | | | | |
| Male | 2.30 (46) | 2.08 (49) | 2.17 (42) | 2.10 (163) | 2.23 (69) | 2.03 (134) | 2.30 (10) | 2.00 (10) |
| Female | 2.34 (68) | 2.17 (59) | 2.18 (62) | 2.27 (133) | 2.14 (50) | 2.42 (57) | 2.17 (6) | 2.25 (4) |
| Activity Only Offered on Weekends | | | | | | | | |
| Male | 2.26 (46) | 1.90 (49) | 2.00 (41) | 2.12 (165) | 2.09 (69) | 1.91 (135) | 2.10 (10) | 1.91 (11) |
| Female | 2.30 (67) | 1.92 (59) | 2.15 (62) | 2.07 (134) | 1.98 (50) | 2.25 57) | 2.00 (6) | 2.50 (4) |
| Activity Only Offered During Summers | | | | | | | | |
| Male | 2.22 (46) | 2.08 (49) | 2.19 (42) | 2.19 (165) | 2.16 (70) | 2.10 (135) | 2.00 (10) | 2.00 (11) |
| Female | 2.46 (65) | 2.19 (59) | 2.37 (60) | 2.28 (132) | 2.28 (50) | 2.37 (57) | 2.17 (6) | 2.50 (4) |
| Relevance of Activity to Your Needs | | | | | | | | |
| Male | 2.09 (44) | 2.04 (47) | 1.90 (42) | 1.93 (162) | 1.90 (68) | 1.91 (132) | 2.00 (10) | 2.00 (11) |
| Female | 1.97 (65) | 1.91 (55) | 1.93 (59) | 1.90 (131) | 1.86 (50) | 1.77 (56) | 2.00 (6) | 1.75 (4) |

APPENDIX C

TABLE C.23 - CONTINUED

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Length of Time Needed to Complete Activity | | | | | | | | |
| Male | 2.13 (45) | 1.95 (49) | 2.07 (42) | 2.08 (164) | 1.94 (68) | 2.04 (134) | 2.40 (10) | 2.09 (11) |
| Female | 2.13 (63) | 1.93 (58) | 1.94 (62) | 2.00 (130) | 2.20 (50) | 2.00 (58) | 2.17 (6) | 2.25 (4) |

* Average/ (Respondents). (Range of responses were from one to three. A value of one indicates a major obstacle to continued professional-growth activity. A value of two indicates a minor obstacle to continued professional-growth activity. A value of three indicates no effect upon professional-growth activity.)

# APPENDIX C

## TABLE C.24

## PERCEIVED OBSTACLES TO CONTINUED PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO ASSIGNMENT LEVEL/AGE GROUPS

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| District Financial Support * | | | |
| Elementary | 1.71 (41) | 1.60 (177) | 1.69 (49) |
| Middle Jr. High | 1.65 (34) | 1.61 (149) | 1.65 (52) |
| High School | 1.54 (68) | 1.63 (229) | 1.66 (115) |
| Obtaining Release Time | | | |
| Elementary | 1.76 (41) | 1.76 (179) | 1.98 (50) |
| Middle Jr. High | 1.80 (35) | 1.68 (148) | 1.81 (52) |
| High School | 1.91 (69) | 1.74 (232) | 1.78 (116) |
| Family/Personal Responsibilities | | | |
| Elementary | 1.85 (41) | 1.86 (180) | 2.24 (50) |
| Middle Jr. High | 2.11 (35) | 1.72 (151) | 2.10 (52) |
| High School | 2.10 (69) | 1.72 (235) | 2.10 (114) |

APPENDIX C

TABLE C.24 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Travel Time to Activity | | | |
| Elementary | 2.17 (41) | 2.16 (177) | 2.30 (49) |
| Middle Jr. High | 2.31 (35) | 2.06 (149) | 2.27 (52) |
| High School | 2.13 (69) | 2.06 (232) | 2.04 (116) |
| Activity Only Offered After School | | | |
| Elementary | 2.17 (41) | 2.15 (178) | 2.37 (49) |
| Middle Jr. High | 2.43 (35) | 2.08 (147) | 2.13 (52) |
| High School | 2.27 (67) | 2.17 (232) | 2.11 (116) |
| Activity Only Offered on Weekends | | | |
| Elementary | 1.88 (41) | 1.97 (178) | 2.18 (49) |
| Middle Jr. High | 2.14 (35) | 1.96 (148) | 2.08 (52) |
| High School | 2.25 (68) | 2.13 (232) | 2.02 (116) |

APPENDIX C

TABLE C.24 - Continued

| Category | 22 - 34 years | 35 - 47 years | 48 - 65 years |
|---|---|---|---|
| Activity Only Offered During Summers | | | |
| Elementary | 2.40 (40) | 2.20 (175) | 2.35 (49) |
| Middle Jr. High | 2.37 (35) | 2.21 (148) | 2.10 (52) |
| High School | 2.47 (68) | 2.19 (231) | 2.07 (117) |
| Relevance of Activity to Your Needs | | | |
| Elementary | 1.93 (40) | 1.79 (177) | 2.03 (47) |
| Middle Jr. High | 2.00 (31) | 1.93 (142) | 1.98 (52) |
| High School | 2.12 (66) | 1.92 (226) | 1.84 (116) |
| Length of Time Needed to Complete Activity | | | |
| Elementary | 2.07 (41) | 2.01 (173) | 2.17 (48) |
| Middle Jr. High | 2.09 (35) | 2.01 (148) | 2.06 (51) |
| High School | 2.13 (67) | 1.98 (229) | 2.07 (117) |

* Average/ (Respondents). (Range of responses were from one to three. A value of one indicates a major obstacle to continued professional-growth activity. A value of two indicates a minor obstacle to continued professional-growth activity. A value of three indicates no effect upon professional-growth activity.)

# APPENDIX C

## TABLE C.25

### PERCEIVED OBSTACLES TO CONTINUED PROFESSIONAL-GROWTH ACTIVITY RELATIVE TO THE ASSIGNMENT LEVEL AND DEGREE HELD BY K - 12 RESPONDENTS

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| District Financial Support * | | | | | | | | |
| Secondary | 1.60 (52) | 1.46 (41) | 1.66 (41) | 1.57 (125) | 1.70 (53) | 1.67 (96) | 2.17 (6) | 2.33 (3) |
| Elementary | 1.82 (34) | 1.41 (32) | 1.50 (36) | 1.70 (92) | 1.63 (30) | 1.69 (39) | 1.00 (2) | 2.00 (3) |
| Middle/Jr.High | 1.57 (21) | 1.72 (29) | 1.36 (25) | 1.69 (67) | 1.61 (31) | 1.64 (53) | 1.71 (7) | 1.67 (6) |
| Obtaining Release Time | | | | | | | | |
| Secondary | 1.93 (53) | 1.74 (42) | 1.90 (41) | 1.72 (129) | 1.66 (53) | 1.76 (95) | 2.17 (6) | 2.33 (3) |
| Elementary | 1.86 (36) | 1.70 (33) | 1.72 (36) | 1.89 (90) | 1.77 (30) | 1.77 (39) | 1.33 (3) | 1.67 (3) |
| Middle/Jr. High | 1.95 (21) | 1.87 (31) | 1.62 (24) | 1.73 (67) | 1.58 (31) | 1.73 (52) | 1.57 (7) | 1.33 (6) |

APPENDIX C

TABLE C.25 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Family/Personal Responsibilities | | | | | | | | |
| Secondary | 2.06 (54) | 1.71 (42) | 1.95 (41) | 1.80 (128) | 1.94 (54) | 1.91 (93) | 2.14 (7) | 1.75 (4) |
| Elementary | 2.06 (35) | 1.82 (33) | 1.81 (37) | 1.82 (92) | 2.10 (30) | 2.08 (39) | 2.33 (3) | 3.00 (3) |
| Middle/Jr.High | 2.10 (21) | 1.80 (30) | 2.08 (25) | 1.69 (68) | 1.89 (31) | 1.91 (54) | 1.71 (7) | 2.17 (6) |
| Travel Time to Activity | | | | | | | | |
| Secondary | 2.30 (53) | 2.00 (42) | 2.12 (41) | 1.99 (128) | 2.15 (52) | 2.03 (95) | 2.00 (7) | 1.75 (4) |
| Elementary | 2.15 (34) | 2.15 (33) | 2.00 (36) | 2.23 (92) | 2.27 (30) | 2.20 (37) | 2.67 (3) | 2.67 (3) |
| Middle/Jr.High | 2.19 (21) | 2.17 (30) | 2.08 (24) | 2.03 (68) | 2.21 (31) | 2.23 (53) | 2.29 (7) | 2.33 (6) |
| Activity Only Offered After School | | | | | | | | |
| Secondary | 2.33 (52) | 2.12 (42) | 2.17 (41) | 2.10 (128) | 2.28 (53) | 2.15 (95) | 2.17 (6) | 2.33 (3) |
| Elementary | 2.26 (35) | 2.09 (33) | 2.11 (36) | 2.27 (90) | 2.13 (30) | 2.13 (39) | 2.33 (3) | 2.67 (3) |
| Middle/Jr.High | 2.38 (21) | 2.13 (30) | 2.25 (24) | 2.09 (67) | 2.13 (31) | 2.13 (52) | 2.29 (7) | 1.83 (6) |

APPENDIX C

TABLE C.25 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Activity Only Offered on Weekends | | | | | | | | |
| Secondary | 2.31 (52) | 1.90 (42) | 2.12 (40) | 2.12 (129) | 2.23 (53) | 2.07 (96) | 1.83 (6) | 2.33 (3) |
| Elementary | 2.09 (34) | 1.79 (33) | 1.94 (36) | 2.05 (91) | 1.87 (30) | 2.05 (39) | 2.00 (3) | 2.67 (3) |
| Middle/Jr.High | 2.43 (21) | 1.97 (30) | 2.17 (24) | 2.01 (68) | 1.90 (31) | 1.87 (52) | 2.29 (7) | 1.67 (6) |
| Activity Only Offered During Summers | | | | | | | | |
| Secondary | 2.33 (51) | 2.02 (42) | 2.22 (41) | 2.21 (128) | 2.24 (54) | 2.20 (96) | 1.83 (6) | 2.33 (3) |
| Elementary | 2.27 (33) | 2.24 (33) | 2.24 (34) | 2.27 (90) | 2.17 (30) | 2.33 (39) | 1.67 (3) | 2.67 (3) |
| Middle/Jr.High | 2.52 (21) | 2.13 (30) | 2.42 (24) | 2.14 (68) | 2.29 (31) | 2.02 (52) | 2.43 (7) | 2.00 (6) |
| Relevance of Activity to Your Needs | | | | | | | | |
| Secondary | 2.10 (50) | 1.98 (41) | 1.88 (41) | 1.96 (126) | 1.83 (53) | 1.88 (93) | 1.67 (6) | 2.00 (3) |
| Elementary | 1.86 (35) | 1.77 (31) | 1.97 (34) | 1.92 (90) | 1.77 (30) | 1.69 (39) | 2.33 (3) | 2.00 (3) |
| Middle/Jr.High | 2.11 (18) | 2.15 (27) | 1.91 (23) | 1.85 (67) | 2.03 (30) | 1.92 (51) | 2.14 (7) | 1.50 (6) |

APPENDIX C

TABLE C.25 - Continued

| Category | BA/BS | BA/BS +18 | BA/BS +30 | MA/MS | MA/MS +15 | MA/MS +30 | EdS | PhD |
|---|---|---|---|---|---|---|---|---|
| Length of Time Needed to Complete Activity | | | | | | | | |
| Secondary | 2.12 (50) | 1.82 (42) | 2.05 (41) | 2.01 (129) | 2.06 (52) | 2.03 (95) | 2.33 (6) | 2.33 (3) |
| Elementary | 2.09 (32) | 2.00 (33) | 2.00 (36) | 2.03 (87) | 2.07 (30) | 2.10 (39) | 2.33 (3) | 2.33 (3) |
| Middle/Jr.High | 2.19 (21) | 2.03 (29) | 1.83 (24) | 2.10 (67) | 2.00 (31) | 1.94 (53) | 2.29 (7) | 2.00 (6) |

* Average/ (Respondents). (Range of responses were from one to three. A value of one indicates a major obstacle to continued professional-growth activity. A value of two indicates a minor obstacle to continued professional-growth activity. A value of three indicates no effect upon professional-growth activity.)

# BIBLIOGRAPHY

# BIBLIOGRAPHY

American Medical Association. "American Medical Association Annual Report 1987, Identifying Physician Needs." Chicago: American Medical Association 1987.

Borg, Walter R., and Gall, Meredith Damien. Educational Research. pp. 559 - 561. New York: Longman, 1983.

Boyer, Ernest L. High School: A Report on Secondary. Education in America. New York: Harper Colophon, 1983.

Butts, David P. "The Survey - A Research Strategy Rediscovered." Journal of Research in Science Teaching (Vol. 20, No. 3, 1983) pp. 187 - 193.

Burden, Paul Robert. Teachers' Perceptions of the Characteristics and Influences on their Personal and Professional Development. Unpublished Ph.D. Dissertation, Ohio State University, 1979.

Chao, Lincoln L. Statistical Methods and Analysis. New York: McGraw Hill, 1969, p. 120.

Cross, K. Patricia. "The Rising Tide of School Reform Reports." Phi Delta Kappan (Vol. 66, No. 3, November 1984) pp. 167 - 172.

DeKarske, Dale R. Professional Development Needs as Perceived by Teachers in Saginaw County. Unpublished Ed.S. Thesis, Central Michigan University, 1980.

Douglas, Claudia, and Kahle, Jane Butler. "A Profile of NABT: Results of the 1982 National Survey." The American Biology Teacher (Vol. 45, No. 8, December 1983) pp. 410 - 414, 423.

Douglas, Claudia B. "Discrepancies Between Men and Women in Science: Results of a National Survey of Science Educators." In Women in Science: A Report from the Field, Jane Butler Kahle, Ed. Philadelphia: The Falmer Press, 1985, pp.148 - 168.

Goodlad, John, I. A Place Called School: Prospects for the Future. New York: McGraw-Hill, 1984.

Heitzeg, Howard, T. Student Enrollment Decline: A Model for Determining Implications for Staffing and Staff Development in the Public Schools. Unpublished Ph.D. Dissertation, Michigan State University, 1978.

Holly, Mary Louise Hulbert. A Conceptual Framework for Personal-Professional Growth: Implications for Inservice Education. Unpublished Ph.D. dissertation, Michigan State University, 1977.

Killian, Joyce; Wood, Fred H.; and Bell, Paul E. "Last Call for Professional Self-Improvement." Educational Leadership (December 1980) pp. 221 - 223.

Linn, Marcia C. "Establishing a Research Base for Science Education: Challenges, Trends, and Recommendations." Journal of Research in Science Teaching (Volume 24, No. 3, 1987) pp. 191 - 216.

Mayer, William D., et. al.. "Continuing Education of Physicians: Conclusions and Recommendations". Journal of Medical Education (Vol. 55, February, 1980) pp. 148 -157.

Moser, C. A., and Kalton, G. "The Coverage of Surveys." Survey Methods in Social Investigation. New York: Basic Books, 1972.

Michigan Science Teachers Association. "MSTA Newsletter." Volume XXXIII, 1988.

Michigan State Board of Education. "Department of Education, State Board of Education, Teacher Certification Code." Lansing, Michigan. July 8, 1989.

Michigan State Board of Education. "1987 Report on Survey of Michigan School Staff Eligible to Retire." Board of Education. Lansing, Michigan. September 1987.

Neuschatz, Michael, and Covalt, Maude. "Physics in the High Schools: Findings from the 1986-87 Nationwide Survey of Secondary School Teachers of Physics." New York: American Institute of Physics, 1988.

Nie, Norman H.; Hull, C. Hadlai; Jenkins, Jean G.; Steinbrenner, Karin; and Bent, Dale H. Statistical Package for the Social Sciences New York: McGraw Hill, 1975.

Ost, David H., and Baird, William E. "Sources of Experienced Secondary Teachers' Skills and Knowledge: A Comparison of Science Teachers With Other Teachers." Science Education (Vol. 73 No. 1, 1989) pp. 71 - 86, 1989.

Peatman, John G. "Samples and Sampling Techniques." Descriptive and Sampling Statistics. Harper and Brothers, 1947, p. 285.

Sanford, Julie P. "Learning on the Job: Conditions for Professional Development of Beginning Science Teachers." Science Education (Vol. 72, No. 5, 1988) pp. 615 - 624.

Saslaw, Rita S. "Survey of Professional Organizations, States, and Teacher Centers: Inservice Education and Professional Development." U.S. Department of Education, ERIC ED 258 931.

Saginaw Public Schools Board of Education. "Agreement Between The Board of Education of the Saginaw Public Schools and The Saginaw Education Association." Saginaw, Michigan, 1988-89.

Smyth, Jon W., and Henry, Colin. " Case Study Experience of a Collaborative and Responsive Form of Professional Development for Teachers," U.S. Department of Education, ERIC ED 238 861.

State of Michigan. "Continuing Medical Education Requirements for Physicians Licensed by the Michigan Board of Medicine." Department of Licensing and Regulation, Bureau of Health Services, Lansing, Michigan. March 1988.

The National Commission on Excellence in Education. A Nation at Risk: The Imperative for Educational Reform. Washington, D.C.: U.S. Government Printing Office, April 1983.

Weiss, Iris. R. Report of the 1977 National Survey of Science and Mathematics and Social Studies Education. Research Triangle Park, North Carolina: Research Triangle Institute, 1978.

Weiss, Iris. R. Report of the 1985-86 National Survey of Science and Mathematics Education. Research Triangle Park, NC: Research Triangle Institute, 1987.

Weiss, Neil A., and Hassett, Matthew J. Introductory Statistics. Massachusetts: Addison - Wesley, 1982, pp.196 - 197.

Yates, Frank. "The Place of Sampling in Census Work, Requirements of a Good Sample." Sampling Methods for Censuses and Surveys. London: Charles Griffin & Company Limited, 1953, pp. 1 - 19.

Youatt, June Pierce. Informal Activities Identified as Contributing to the Professional Development of Selected Michigan Home Economics Teachers. Unpublished Ph.D dissertation, Michigan State University, 1983.

Yovanovich, Sue Ann. Continued Professional Development for Teachers: Teacher and Administrator Perceptions. Unpublished Ph.D. Dissertation, Michigan State University, 1987.