A Strategy for Inservice Education of Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System

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A STRATEGY FOR INSERVICE EDUCATION OF JUNIOR-HIGH/MIDDLE-SCHOOL SCIENCE TEACHERS IN THE GRAND RAPIDS PUBLIC SCHOOL SYSTEM

by

David Andrew DeGraaf

A Dissertation
Submitted to the
Faculty of The Graduate College
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David Andrew DeGraaf
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CHAPTER I - THE PROBLEM AND ITS BACKGROUND

Introduction

"The hallmark of a profession is the recognized competence of its membership. As science teaching advances to professional status, the need for continuing competence becomes more critical" (Richardson, 1960, p. 296). These viewpoints form the basis for a major challenge in science education today. That challenge is to provide in-service education for science teachers. The National Science Teachers Association (1978, p. 29) affirmed this challenge by stating that, "the consensus, among science educators, is that quality in-service education is the most important factor in the health of science teaching as a whole and the factor most in need of continuous attention."

When attention is focused on the in-service education of junior-high/middle-school science teachers, certain questions arise. Such questions include (a) What are the historical roots of in-service education for science teachers? (b) What is the present status of the in-service education of science teachers? and (c) What characterizes an effective in-service-education plan for science teachers? This study addresses questions such as these in an attempt to present a strategy for the in-service education of science teachers at the junior-high/middle-school level in the Grand Rapids Public School System.

Defining Inservice Education

The definitions of the term, in-service education that appear in the literature are quite diverse and complex. Thus, the recognition
of certain implications and connotations of this term is important in formulating an operational definition of inservice education for this research study. The following implications and connotations of inservice education are described below: (a) repair and remediation, (b) programs, services, and activities, (c) professional growth and development, and (d) updating or keeping abreast of change.

**Inservice Education as Repair and Remediation**

To some educators, inservice education implied repair and remediation. Jackson (1971, p. 21) called this the "defect" point of view. He indicated that, for certain people, inservice education begins with the assumption that something is wrong with the way practicing teachers operate and the purpose of inservice training is to set them straight—to repair their defects, so to speak.

**Inservice Education as Programs, Services, and Activities**

To other educators, inservice education connotes programs, services, and activities. Participants at a Leadership Training Institute sponsored by the American Association of Colleges for Teacher Education emphasized these notions in their definitions. Massarari (1977, p. 21) summarized the definitions as follows:

1. Field-based services delivered after initial certification of systematic activities promoted or directed by the district and designed to increase competencies needed by personnel in the performance of their assigned duties.

2. Programs designed to facilitate the continued professional growth of school personnel.

3. Activities which provide experiences for teachers to update
for new trends, skills, certification, and for personal
development.

4. Planned services and activities specific to the needs of the
client: teachers.

The concept of "activity" is expressed in the following definition for­
mulated by participants at the Workshop on Reconceptualizing Inservice
Education sponsored by the National Education Association (Edelfelt and
Johnson, 1975, p. 5).

Inservice education of teachers is defined as any professional
development activity that a teacher undertakes singly or with
other teachers after receiving her or his initial teaching certi­
ificate and after beginning professional practice.

Likewise, this view is expressed by Hass (1957, p. 13) in the 56th Year­
book of the National Society for the Study of Education, In-Service
Education. To him inservice education included, "all activities engaged
in by the professional personnel during their service and designed to
contribute to improvement on the job."

Inservice Education as Professional Growth and Development

Some educators believe that inservice education implies profes­
sional growth and development. This "growth" point of view is expressed
by Harnley (1949, p. 272) where he defined inservice education as, "any
procedure or activity which brings about growth in one's teaching, such
as summer school, conferences, or visits to other schools." This con­
cept is also emphasized by Cook (1964, p. 13) who defined inservice
education as, "all those activities which are designed to contribute
to the professional growth and competence of the classroom teacher."
Likewise, the National Education Association (1956, p. 3) stated that
inservice education involves, "efforts of administrative and supervisory
officals to promote by appropriate means the professional growth and development of educational personnel." Richardson, Williamson, and Stotler (1968, p. 95) identified academic and professional growth to be essential components for the inservice education of science teachers. They explained that academic growth of inservice science teachers should include both breadth and depth of study in the sciences. Professional growth, according to Richardson et al., involves study in science curriculum, methodology of teaching and evaluation.

Inservice Education as Updating or Keeping Abreast of Change

The concept of "updating" is prevalent in descriptions of inservice education of science teachers. This concept is implied in the definition of inservice education for science teachers found in the 46th Yearbook of the National Society for the Study of Education (1947, p. 273), Science Education in American Schools. According to the Yearbook, inservice education means, "keeping abreast of changes in knowledge of subject matter as well as educational theory and practice."

The Definition

In view of the concepts that were discussed about inservice education, this study will define inservice education as any programs or activities in which a teacher participates that contribute to his/her professional growth and competence in subject matter. The specific concern of this study is to develop a strategy of programs and activities for the inservice education of the junior-high/middle-school science teacher in the Grand Rapids Public School System.
History of Inservice Education of Science Teachers

In an attempt to establish a rationale for this study, it seems important to examine historical trends in the inservice education of science teachers during this century. These trends must be viewed in the light of changes that have occurred in our society, in general, and in science education, in particular. In the following sections, these trends are described in six sequential periods.

Period I (1900-1910) - The Era of College Domination

During the first decade of this century science teaching was under strong control of colleges and universities. An important reason was that high schools conformed to the recommendations of the Committee of Ten of the National Education Association. In a 1894 report, the Committee vowed, "to make all main subjects taught in the secondary schools of equal rank for the purpose of admission to college or scientific schools" (National Education Association, 1894, pp. 51-52).

The effect of this college domination of high schools on the inservice training of science teachers is described by Cahoon and Richardson (1950, p. 178).

At the turn of the century, teaching in secondary schools in the areas of science and mathematics ... was greatly under the influence of the Report of the Committee of Ten. ... To utilize science and mathematics to train the minds of boys and girls to prepare them equally well for college or for vocational work, it was thought that teachers needed only to have background in subject-matter. The term "training" as applied to teachers was probably quite accurate in the sense that they needed to go through courses where emphasis was placed upon formal and systematic study of subject matter in order to be able to present it similarly to secondary school pupils.

Evidence of this subject-matter, formal-type inservice training

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for science teachers is found in some early issues of *School Science* and *School Science and Mathematics*. Contained in certain issues between 1900 and 1910 are advertisements for summer courses for science teachers at universities such as Cornell, Harvard, Wisconsin, and Chicago. Among the courses being offered were those in physics, chemistry, botany, and geology.

During this period, the domination of colleges on high-school science teaching was a probable factor that caused science teachers to organize into professional associations. Examples of some of these organizations are the (a) Department of Natural Science Instruction of the National Education Association, founded in 1895; (b) New York State Science Teachers Association, founded in 1896; (c) Central Association of Physics Teachers, founded in 1902, expanded the following year to form the Central Association of Science and Mathematics Teachers (Johnson, 1978, p. 125); and (d) American Federation of Teachers of the Mathematics and Natural Sciences, founded in 1906 (Mann, 1907, p. 338).

One of the many functions of these organizations was providing inservice education. In describing some of these early organizations, Johnson (1978, p. 125) stated they were formed, "for the purpose of developing an effective voice for the views of high-school science teachers on curriculum and instructional problems." In describing the earlier inservice-education programs of the Central Association of Science and Mathematics Teachers, Schrieber and Warner (1950, p. 5) stated that, "these programs stressed information relative to current developments in the field of mathematics and science as opposed to discussions on pedagogical routines and methods."
During this period, inservice activities for science teachers were primarily subject-matter courses offered and controlled by colleges and universities. Responding to this college domination, science teachers began to organize into professional associations in order to stimulate inservice activities suited more to their needs.

**Period II (1910-1929) - The Reorganization of Secondary-School Science**

From 1910 to the Great Depression of 1929, significant changes occurred in the philosophy and structure of secondary science education. Philosophical changes were influenced by a report of the Commission on the Reorganization of Secondary Education of the National Education Association (1918) entitled, *Cardinal Principles of Secondary Education*. According to the report the major aims of education should be concerned with (a) health, (b) worthy home membership, (c) citizenship, and (d) ethical character as opposed to preparation for college. According to Bossing and Cramer (1965, p. 21), "educators have regarded this report in many ways as the 'Magna Carta' declaration of freedom of the secondary school from the domination of the college and university."

Both philosophical and structural changes in science education were influenced by another of the Commission's reports, *The Reorganization of Science in Secondary Schools* by Caldwell (1920). In addition to establishing a sequence of high-school science courses that included general science in the junior high, the report also called for application of certain "Cardinal Principles" to science instruction.

In conjunction with these reports, the junior-high school and the subject of general science became recognized and rapidly grew. According
Hunter (1934, pp. 20-21), the number of junior-high schools went from four in 1910 to 4,834 in 1932. Hunter also reported that the percentage of secondary schools offering general science grew from 3.3% in 1908 to 83.9% in 1933 (1934, p. 35). During this period, the inservice-education opportunities for science teachers reflected these forces at work in science education. For example, Cornell University offered a summer physics course for teachers that was described as "novel" because it was being taught by an experienced physics teacher rather than a college professor (School Science and Mathematics, 1912, p. 546). Also, in a later issue of School Science and Mathematics (1917, p. 550), no less than 10 universities and normal schools advertised summer courses in the teaching of general science.

The growth in the number of general science teachers created a problem that stimulated and expanded inservice education activities. This problem, still evident today, is described by Briggs (1927, p. 656).

Since a prospective teacher of general science gives all or nearly all of his science time to one subject in college, he fails to study some of the fields his later teaching assignment includes. . . . Those out of college and in teaching positions may supplement their training by occasional added courses of instruction, by personal study, and by magazines and books of which many are available.

However, up to this point in the century, the college course remained the primary type of inservice-education activity for science teachers because many of them were seeking to fulfill certification requirements that were constantly being upgraded. In describing inservice education during this period, Rickey (1957, p. 65) remarked:

As academic and professional qualifications of teachers were raised . . . employed teachers were left with little choice but to acquire more academic education and professional training of
a type that could be translated into course credits, normal-
school diplomas, advanced certificates and college degrees. For
a long time, programs designed to upgrade the teaching staff over-
shadowed all other inservice efforts.

During this second period, inservice activities for science
teachers began to include methods courses in addition to subject-matter
courses. The emergence of general science as part of the secondary
curriculum found many science teachers unprepared and in need of in-
service training in both subject matter and methodology. The college
continued to dominate inservice activities as teachers took courses in
pursuit of certification requirements.

Period III (1929-1945) – The Depression and World War II Years

The child labor and mandatory education laws that preceded the
Great Depression of 1929, caused a great influx of students into the
public schools. Many of these students in high schools did not intend
to go to college and found the existing curriculum to be irrelevant to
their needs (Preston, 1936, p. 33).

Responding to this dilemma, the Committee of the 31st Yearbook
of the National Society for the Study of Education, A Program for
Teaching Science, recommended a science curriculum that stressed gen-
eralizations of science and scientific attitudes as opposed to an
accumulation of facts. The Committee also declared that science teach-
ing must contribute to the general aim of education which is life en-
richment (Whipple, 1932).

Another response to the call for curriculum reform was the Eight-
Year Study conducted by Wilford Aiken (1942) of the Progressive Educa-
tion Association. Begun in 1932, the study challenged the traditional,
college-preparatory curriculum in high school by showing the effectiveness of a more "progressive" curriculum that was based on the student needs.

Emerging from the Eight-Year Study was a report by the Committee on the Function of Science in General Education, Science in General Education. The Committee, chaired by V. T. Thayer (1938), a controversial figure of the day, recommended that science curriculum focus on the needs of adolescents regarding, (a) basic aspects of living, (b) personal-social relationships, (c) social-civic relationships, and (d) economic relationships.

One result of recommendations of both the Eight-Year Study and the 31st Yearbook was the need for schools to design new curricula by identifying new content and developing new instructional materials. These tasks brought inservice teachers and administrators together for the first inservice-training workshops. According to Tyler (1971, p. 12), the first such workshop was held at Ohio State University in 1936 for teachers from each of the 30 schools involved in the Eight-Year Study. Tyler claimed that the workshop proved very helpful in putting new ideas into practice in the schools and in affording a means for the education of teachers.

Barnard (1978, p. 5) described his involvement with science teachers in these first workshops:

During our earlier experiences in introducing ways of bringing about changes in the schools and helping teachers to implement those changes, we have been introduced to the concept of inservice education workshops for administrators and teachers as an effective way of bringing about desired change. . . . One basic assumption underlying this approach was that fundamental changes in a school's curriculum should take place by democratic processes involving teachers who will be responsible for implementing the
changes.

The fact that workshops were being implemented is evident from a description by Powers and Laton (1948, p. 359) of a series of summer workshops for science teachers, started in 1939 at Teachers College, Columbia University. These workshops were carried on to help teachers achieve a working understanding of the ways in which the scientific methods and discoveries affected everyday life.

During this period, the workshop was among many opportunities for the inservice education of the science teacher. For example, in Science Teaching at Junior and Senior High Levels, Hunter (1934, pp. 524-525) recommended:

Every teacher should be supplied with some magazine or other sources which will allow him to keep abreast of these changes in science. . . . The best way to keep alert is to join your local teachers association, attend meetings, take part in discussions and, if possible, prepare papers in your own departmental meetings. Subscribe to such journals as Science Education and School Science and Mathematics. . . . If possible attend summer school. . . . Keep up-to-date through the inspections of new texts, tests, and motivating devices of various kinds.

Likewise, in a 1942 report of the National Committee on Science Teaching of the National Education Association, Powers (1942, pp. 66-71) recommended cooperation between administrators and teachers in planning such inservice education programs as (a) group activities, (b) independent study through reading, (c) participation in courses and workshops, (d) observations of fellow teachers, and (e) participation in community activities.

During this period, inservice activities for science teachers became localized and diversified as they moved away from being college-controlled toward being local-school controlled. The workshop became
a popular form of inservice training as teachers cooperated with other school personnel to revise curriculum and instruction.

**Period IV (1945-1955) - Postwar Problems**

Such technological achievements as radar, infrared photography, and nuclear energy, developed during World War II, convinced many people of the importance of science to the future of the United States. Many people also realized that after the war there existed a shortage of trained scientists and engineers that were needed to exploit these achievements. However, only a few people realized the relationship between the shortage of trained scientists and a shortage of trained science teachers.

This relationship was detailed by Steelman (1946), chairman of the President's Scientific Research Board. Of the five volumes devoted to a discussion of various facts of the scientific personnel problem, Volume 4, *Manpower for Research* made recommendations regarding inservice education of science teachers. Those recommendations included (a) postgraduate fellowships, (b) inservice training workshops, (c) science supervisors, and (d) curriculum revision.

Despite strong recommendations to the Federal Government, it was certain industries that first considered the shortage in scientific personnel critical enough to invest in the upgrading of science teachers. For example, starting in 1945, General Electric supported the Summer High School Teacher Fellowship Program whose objectives included the improvement of high-school science teaching. The program, that was based at Union College in New York and Case Institute in Ohio, was

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designed primarily for updating high school science teachers in content areas. According to the Crane Report (1976, p. 34), approximately 2,500 public, private, and parochial teachers received training through this program during a 15 year period.

Another example is the Science Teacher Program started by Westinghouse Educational Foundation in 1949. In this program, Westinghouse sponsored science teachers for summer activities at Massachusetts Institute of Technology that included not only lectures in the science-content areas but also field trips and informal conferences on science teaching.


Another important contribution to the cause of inservice education of the science teacher was the recommendations of the Inservice Committee of the 46th Yearbook of the National Society for the Study of Education entitled, Science Education in American Schools (Nelson, 1947, p. 287). Among the recommendations, one clearly reflected the urgency, characteristic of this period, for the inservice education of science teachers.

All available resources, local, state, and federal should be utilized to the fullest extent in the inservice education of science teachers. Every effort should be made to develop in science teachers an understanding of their responsibilities as citizens and the important contribution which they can make to society through teaching of science.

Another recommendation in the Yearbook failed to produce much action during this period. According to Mallinson (1958), a reason for this failure was that the Yearbook contained much academic pedagogy.
about what should be done with little consideration on how to do it. However, this recommendation in the Yearbook proved to be a forecast of modern thinking on inservice education, namely, that "inservice education should be locally initiated, directed to the needs of the individual teacher, cooperatively planned and carried out."

During this fourth period, inservice activities for science teachers were initiated by industries that were interested in upgrading the subject matter of science teachers. Despite recommendations to the contrary, the focus of inservice activities shifted away from local, instructional problems and returned to upgrading science teachers in subject matter on a national level.

Period V (1955-1970) - The Rise of the National Science Foundation

Although the United States government established the National Science Foundation (NSF) in 1950 with a mandate to improve science education, it was not until 1955 that NSF began supporting the inservice education of science teachers.

The shift of the science education efforts of the NSF from college to high school was due, in part, to a realization expressed in its Fifth Annual Report (1956, pp. 70-72). The Report stated that, "a most critical and immediate limiting factor in developing latent science talent in the youth of the U.S. was the dwindling supply of adequately trained science teachers."

Another reason for this shift was congressional pressure, partially due to a publication by DeWitt (1955), Soviet Professional Manpower that indicated Russia was producing trained scientists and technicians
at an impressive rate.

Nevertheless, the NSF in 1955 began supporting various inservice-training efforts for science teachers. One such effort was the institute programs that included summer, academic-year, and in-service institutes. Summer institutes provided subsidized opportunities for science teachers to receive subject-matter training during the summer. Academic-year institutes allowed a teacher to take a leave of absence from teaching and attend special, full-time programs at a university. In-service institutes provided an opportunity for teachers to receive subject-matter training during evenings or Saturdays during the academic year.

Another program that started during the mid-1950's was the Course Content Improvement Program (CCIP). Beginning with the Physical Science Study Committee (PSSC) in 1956, NSF supported several teams of scientists, science educators, and science teachers to develop new curricula for secondary science.

The growth of these programs was modest until 1957, when the launching of Sputnik by the Soviet Union brought to national awareness the strength of Soviet technology and stirred public demand in the U.S. for more education in the sciences (Hausman, 1978, p. 220). The result was that the number of institutes supported went from 29 in 1956, to 133 in 1957, to 230 in 1958, and 607 in 1959. In 1959 alone, 30,523 teachers participated in institutes compared with 1,390 in 1956 (Crane, 1976, p. 88).

Likewise, during this time, funds for Course Content Improvement Program increased from half a million dollars in 1957 to four million
dollars in 1959.

The decade of the sixties was characterized by steady growth in the major programs plus the development of some new ones. One such program that gained recognition during the sixties was the Cooperative College-School Science Program (CCSSP). This program involved collaboration between a college or university and secondary-school and/or elementary-school teachers and administrators in planning, adapting, and introducing newly developed science curricula into nearby school systems.

The middle to late sixties was the most active time for NSF in-service programs for science teachers. Hausman (1978, p. 221) claimed that 1965 was the peak year with 40 million dollars supporting 37,000 teachers at 492 summer institutes, 64 academic-year institutes, and 313 in-service institutes. Lomask (1976, p. 124), on the other hand, claimed 1968 was the peak year with 43.8 million dollars supporting 43,612 teachers at 518 summer institutes and 183 academic-year institutes.

It is evident from the number of in-service-education opportunities provided, and the number of participants, that this period of NSF domination was a major period in the history of in-service education of science teachers. The significance of this period has been expressed by several educational leaders. For example, Conant (1963, p. 207) remarked that, "the use of summer institutes for bringing teachers up to date in a subject-matter field has been perhaps the single most important improvement in recent years in the training of secondary school teachers." Ray (cited in Kriegbaum and Rawson, 1964, p. 4)
of the Division of Sciences, Washington State University stated that, "the Institute Program has been more responsible than any other factor in achieving a substantial up-grading of competence of science and mathematics teachers in secondary schools." Mallinson, Dean of the Graduate College, Western Michigan University (1962) commented that, "without regard for the ultimate merit of these Institute programs, no single activity has ever had a greater impact on American Education."

The inservice-training efforts of NSF affected many science teachers and also the philosophy of inservice education. According to Krieghbaum and Rawson (1969, p. 333):

In the long view of history, possibly the greatest contribution will be that the NSF institutes . . . helped to focus an evolving philosophy of teacher training on a key idea: That subject-matter courses should receive essential emphasis. The 'workshop' idea that centered around how-to courses has been supplanted by subject-oriented work, such as that given in institutes. This key idea has been adopted not only for other educational areas in the U.S. but by foreign countries.

During this fifth period, many opportunities were available for science teachers to update and upgrade themselves in their knowledge of subject matter. Also, there were many opportunities for teachers to become involved in curriculum planning and implementation. Opportunities abounded because the nation placed a high priority on the inservice education of science teachers.

Period VI (1970-1980) - The Decline of NSF Support

Compared with the previous period, this most recent period was characterized by a decline in both the quantity and quality of inservice education for science teachers.

It was evident during the early 1970's that NSF inservice programs
had reached a substantial number of teachers. A 1971 national survey of secondary science teachers by Schlessinger et al. (1973, p. 119) indicated that over 50% of them had attended NSF institutes. However, for many reasons, the number of programs supported by NSF significantly declined through the period. Among the reasons for this decline was that NSF priorities were shifting away from science education toward science research. Also, priorities in science education were shifting away from inservice programs for science teachers to preservice programs, social science programs, and community education programs (Crane, 1976).

This decline in inservice programs was evident by the fact that in 1976 there were no more institutes or curriculum implementation programs supported by NSF. However, since 1977, with the inception of the Pre-college Teacher Development in Science Program, there has been a small increase in the number of inservice-education opportunities for science teachers. However, with only 6.8 million dollars to be divided between elementary and secondary mathematics, social studies and science teachers for 79 summer projects and 189 academic year projects in 1979, it is clear that the number of opportunities for science teachers does not compare with that of previous years (National Science Foundation, 1979).

During this sixth period, with the withdrawal of federal support for inservice training of science teachers, there was little evidence that state departments and local school districts carried on inservice activities of the type offered previously. A review of the literature failed to show that the impetus established by NSF programs continued.
either as activities by state and local agencies or by colleges and universities. In fact, the literature is practically devoid of any such references.

**Dilemma in the Inservice Education of Science Teachers**

The history of inservice education of science teachers, previously described, revealed that the number and variety of opportunities for inservice education increased steadily from the turn of the century and peaked in the late sixties. During this past decade, however, the number and variety have declined significantly. In a recent report on the status of science education, Helgeson, Blosser, and Howe (1977, p. 70) described the situation. "However, with reduced funding from federal sources and increased demands on tighter budgets at the state and local levels, emphasis on inservice science education has declined since the early 1970's."

History also revealed that the responsibility for inservice education of science teachers has shifted from the university to the local school system to the Federal Government. Recently the responsibility for inservice education of science teachers has returned to local and regional districts. But, there has been heavy criticism about the quality and quantity of that education. For example, in the 74th Yearbook of the National Society for the Study of Education, *Teacher Education*, Cogan (1975, p. 220) stated:

The in-service programs sponsored by schools are generally rationalized as constituting the continuing education of already competent professionals. However, the dollar inputs, the expertise, and the time deployed in these efforts are almost universally insufficient to spark genuine professional gains among teachers. In-service programs therefore often have more
form than content and too often represent a poor use of scarce resources and a waste of teachers' time and efforts.

Criticisms of local inservice-training efforts for science teachers also appeared in a recent report by the National Science Teachers Association (1978, p. 27):

1. Many teachers still report that limited opportunities for inservice education exist in their area.
2. Other teachers indicate that heavy teaching loads prevent them from participating in inservice.
3. Inservice activities often are scheduled after the school day when teachers are both mentally and physically tired.
4. Too often, inservice programs feature meetings that have not been preceded by any teacher input or planning and will not be followed up in any way. Such meetings normally result in a minimum of new insight and progress.
5. Initial enthusiasm for a new curriculum program or a new strategy likely is to be followed by disillusionment if the teacher is not helped to meet the various problems that arise during the implementation period.

Unfortunately, as the quantity and quality of inservice programs have diminished, the inservice-education needs of science teachers have not. For example, in a survey of 344 science teachers, Lawrenz et al. (1974) determined inservice needs to be (a) curriculum techniques, (b) evaluation, (c) individualized instruction, and (d) science careers. After surveying 309 science teachers, Stronk (1974) found their inservice needs to be (a) coordination of the K-12 sequence, (b) recent advances in scientific knowledge, (c) relating concepts to lives of students, (d) management of curriculum materials, (e) individualized instruction, and (f) evaluation. Falls and Fryman (1974) surveyed the needs of science teachers and found that 92% wanted to learn more about recent advances in science whereas 74% needed improvement in

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their understanding of basic science concepts. Moore (1978) surveyed 300 secondary science teachers and found their needs to include (a) obtaining and utilizing science materials, (b) science teaching methodology, and (c) providing meaningful science experiences.

In addition to the type of inservice needs for secondary science teachers, in general the junior-high/middle-school science teacher appears to have certain unique inservice needs. Helgeson et al. (1977, p. 71) summarized research relative to those needs.

1. When junior high science teachers are considered as a separate sub-group of secondary science teachers, these people (on the whole) lack depth in more than one area of science. Yet many fill general science teaching assignments.

2. Junior high science teachers are less satisfied with the science curricula available, considering them less relevant to their pupils than they could be. They also express dissatisfaction with teaching conditions, in terms of classroom facilities, equipment, and storage space.

3. Junior high science teachers need special preparation if they are to help their pupils become aware of the variety of careers in science as well as helping to encourage scientific literacy.

Faber (1974, pp. 60-61) surveyed 475 science teachers and concluded that the preparation of junior-high science teachers was less satisfactory than for senior-high science teachers. His study also showed that only 24.9% of junior-high teachers participated in NSF summer institutes, compared to 45.5% for high school teachers. Only 27.2% of these junior-high teachers had participated in NSF inservice institutes and 8.2% participated in academic-year institutes.

In summary, a dilemma now exists regarding the inservice education of junior-high/middle-school science teachers. That dilemma is the existence of unique inservice-education needs of the junior-high/middle-school science teacher, combined with inaction by local-school
systems to respond to those needs.

The Problem

The dilemma, just described, has created a need for the development of a strategy for the inservice education of junior-high/middle-school science teachers at a local level. In a discussion of inservice science education, Hurd (1978, pp. 114-115) confirmed this need in this statement. "Be this as it may, it is clear that a well-conceived system of in-service education . . . is needed to introduce new curricula and instructional materials into schools." Hurd concluded with this challenge.

The problem is to create in-service programs that are of sufficient intellectual quality to stimulate professional growth . . . The difficulty of this task is awesome, but dare we strive for lesser ends? Do we plan the future of our field or do we settle for the status quo and default to the inertia that has plagued the educational enterprise for centuries?

Based on the lessons of history, the current dilemma, and the challenge to address that dilemma, this study will develop a local strategy for the inservice education of junior-high/middle-school science teachers.

An important factor in the development process is establishing a research base. Blosser (1969, p. 30) discussed this viewpoint as follows:

Another concern is the lack of a research base for the plan of action involved in many local programs. This lack may result in a program or plan that is not really appropriate because it may treat the symptoms without ever identifying and dealing with the cause.

Establishing a research base for this study will require acquisition of certain theoretical and empirical data. The literature
contains guidelines for developing inservice strategies and it is important to delineate those guidelines that can be applied to this study.

The empirical data, that will be collected from a specific population of junior-high/middle-school science teachers, will include information about inservice-education needs, perceptions and experiences.

Together, the data will form the conceptual framework for an inservice strategy. The conceptual framework will include the following factors:

1. General characteristics of teachers.
2. Inservice-education background of teachers.
3. Perceived inservice-education needs of teachers.
4. Purposes of inservice education.
5. Levels of organization of inservice programs and activities.
6. Formats of inservice programs and activities.
7. Topics for inservice programs and activities.
8. Teacher's roles in inservice programs and activities.
10. Locations for inservice programs and activities.
11. Frequency in conducting inservice programs and activities.
12. Times when inservice programs and activities are scheduled.

In order to focus on the problem, the following questions were developed to guide the collection of data:

1. What are some general characteristics of the junior-high/middle-school science teachers for which the inservice-education strategy
is being developed?

2. What are the inservice-education backgrounds of the junior-
high/middle-school science teachers for which the inservice-education
strategy is being developed?

3. What are the perceived inservice-education needs of the junior-
high/middle-school science teachers for which the inservice-education
strategy is being developed?

4. What guidelines can be elicited from the current literature
that can be applied to an inservice-education strategy for junior-high/
middle-school science teachers?

5. What perceptions do these junior-high/middle-school science
teachers have toward certain parameters of inservice education?

From the information obtained, a strategy will be presented re-
garding inservice-education programs and activities for these junior-
high/middle-school science teachers in the context of their local
school system.
CHAPTER II - RESEARCH DESIGN

Introduction

This research study has two components, the first of which is to review the literature in order to elicit specific guidelines concerning certain parameters of inservice education. In this component, the ultimate aim is to apply those guidelines to a strategy for inservice education of junior-high/middle-school science teachers.

The second component is a status study to survey a group of junior-high/middle-school science teachers to determine their (a) personal characteristics, (b) inservice-education background, (c) perceived inservice-education needs, and (d) perceptions of certain inservice-education parameters. Two questionnaires were developed for these purposes and distributed to the selected group of teachers. The responses to the items on these questionnaires, combined with information obtained from the literature, were used to develop the inservice-education strategy.

The Questionnaires

Science Teacher Needs Assessment

A copy of the first instrument, the Science Teacher Needs Assessment, appears in Appendix A. The basic format and content of this questionnaire were those of the Moore Assessment Profile (MAP) developed by Moore (1977). A list of inservice-education needs, many of which were taken from the MAP, were reviewed by a steering committee of junior-high/middle-school science teachers representing each school in...
the Grand Rapids Public School System. After adding, deleting, and modifying certain items, a list of 46 potential needs were incorporated in the assessment instrument.

Items in the assessment were designed to provide information about specific inservice-education needs of junior-high/middle-school science teachers. Items one and two are needs for the development of a better understanding of students. Items three and four deal with the improvement of diagnosis and evaluation practices. Items five to seven are related to better classroom management practices. Items eight to 19 are needs for improvement of classroom instruction and planning. Items 20 to 28 and 34 to 46 are needs for more effective use of instructional materials. Items 29 to 33 are needs for self-improvement of the classroom science teacher.

Because of these modifications, the reliability and construct validity established by Moore could not be attributed directly to the modified questionnaire. However, since both the Science Supervisor and the Director of Evaluation for the school district reviewed and approved the instrument, it was believed that their suggestions for improvement contributed to the face validity of the instrument. In addition, before the form was finalized, it was examined and approved by the investigator's Doctoral Advisory Committee.

The final instrument was designed as a checklist that could be completed by teachers in about 10 minutes. This design was used to minimize possible reluctance by teachers to complete the instrument.
Science Teacher Professional Development Survey

A copy of the second instrument, the Science Teacher Professional Development Survey, also appears in Appendix A. Some ideas for items in the first section, General Information, were taken from a questionnaire developed by Faber (1974). All the items in this section were designed to gain an understanding of general characteristics of the teachers for whom the inservice-education strategy was being developed.

Certain ideas for items in the second section, Inservice Education Experience, were taken from a survey developed by the National Science Teachers Association (1970). The items in this section were designed to determine the degree and variety of inservice-education experiences of the participants in the study.

In designing items for the last section, Perceptions of Inservice Education, ideas were taken from an instrument used in a study by Zigarmi, Betz, and Jensen (1977). The items contained in this section were designed to learn how junior-high/middle-school science teachers perceive certain parameters of inservice education. Those parameters of inservice education include: (a) purpose, (b) organization, (c) format, (d) topics, (e) teacher's role, (f) influencing people/organizations, (g) frequency, and (h) meeting time.

Prior to using this questionnaire, members of the investigator's Doctoral Advisory Committee for this research study agreed to review its format and content. Their suggestions for improvement were incorporated in the final questionnaire and contributed to its face validity.

As with the Needs Assessment instrument, the second questionnaire was designed as a checklist to be completed in about 10 minutes. The
rationale for this design, as with the Needs Assessment, was to minimize possible reluctance by teachers to complete the questionnaire.

Data Collection Procedures

The literature review process began with a search of the Education Index, Education Resources Information Center (ERIC) Index, and the card catalog in the libraries of Western Michigan University. From these sources, papers and articles that described inservice-education models, strategies, programs and activities were identified and subsequently reviewed. Finally, those writings that described ideas that were compatible with the objectives of this study were selected for analysis.

The process of collecting empirical data began by introducing the Junior-High/Middle-School Science Teacher Professional Development Project at a meeting of science department heads, representing the junior-high/middle-schools in the Grand Rapids Public School System. Subsequently, a steering committee consisting of one science teacher from each of the junior-high/middle schools in the school system was formed to assist in administering the questionnaires and communicating the progress of the study to the participating teachers. The steering committee was established on the assumption that these members could facilitate communication between the researcher and the research participants.

Copies of letters to department heads, steering-committee representatives and teacher participants appear in Appendix B. The first mailing listed names of the steering committee, introduced the research
study to the teachers, and described the needs assessment process.

The Needs Assessment forms were personally distributed by this investigator to, and collected by this investigator from, steering committee members at their schools during fall parent-teacher conferences, in order that teachers could conveniently complete them between conferences. Shortly thereafter, letters were sent to the steering committee members thanking them for their help, informing them of progress in the assessment, and asking them for any questionnaires that had been turned in late. After the questionnaires had been returned, the responses were tabulated and discussed at a meeting of steering committee representatives. A summary of these results were then distributed to all teachers involved.

The instrument, the Science Teacher Professional Development Survey, was introduced to the steering committee by means of a letter. Shortly thereafter, copies of the questionnaire, accompanied by a cover letter giving participants a rationale for the effort, were distributed by this investigator to steering committee members at their schools. After the committee members distributed and collected the forms, they were returned for analysis. A letter of appreciation to the committee members was followed by a letter to all participants that included a summary of the results. Correspondence relative to the Professional Development Survey appear in Appendix B.

Data Analysis

Relevant information elicited from the literature review is presented in summary form in Chapter III. Such information includes
guidelines and suggestions concerning those parameters, listed in Chapter III, page 35.

Responses to the items on the Needs Assessment were assigned numerical values based on the intensity of the need. These values ranged from 1.0 for "no need" to 4.0 for "much need." After the responses were tallied and totaled, a mean value was determined for each need by dividing the total by the number of responses. The needs were then listed in ascending order and grouped on the bases of these mean values. Needs with mean values between 3.0 and 4.0 were considered critical. Needs with mean values between 2.0 and 3.0 were considered moderate whereas those between 1.0 and 2.0 were considered slight. The results are presented in tabular form in Chapter III.

Responses to the items in the General Information and Inservice Education Experience sections of the Professional Development Survey were totaled according to frequency of response. However, responses to items in the section, Perceptions of Inservice Education, were treated in a similar fashion to those in the Needs Assessment. Responses were assigned a numerical value based on the degree of preference for the item. The values ranged from 1.0 for "inappropriate" or "unimportant," to 3.0 for "very appropriate" or "very important." After a mean value was determined for each response, items were listed in ascending order of value under each major heading. Items with mean values between 2.0 and 3.0 were considered to be appropriate or important whereas those with values between 1.0 and 2.0 were considered to be inappropriate or unimportant. The results of the Professional Development Survey are presented also in tabular form in Chapter III.
The Population

The population consisted of 48 junior-high/middle-school science teachers currently employed by the Grand Rapids Public School System. They were selected because of their accessibility and the desire to limit the population to a workable number. The population appeared representative of the variety of teaching conditions existing among the different schools. Table 1 lists the junior-high/middle-schools in Grand Rapids and the number of science teachers in each to whom questionnaires were sent. Figure 1 shows the location of these schools within the Grand Rapids Public School System.

Table 1
Schools and Number of Their Teachers to Whom Questionnaires Were Sent

<table>
<thead>
<tr>
<th>School</th>
<th>Science Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burton Junior High</td>
<td>8</td>
</tr>
<tr>
<td>City Junior High</td>
<td>1</td>
</tr>
<tr>
<td>Educational Park</td>
<td>2</td>
</tr>
<tr>
<td>Harrison Park Junior High</td>
<td>4</td>
</tr>
<tr>
<td>Iroquois Middle</td>
<td>7</td>
</tr>
<tr>
<td>Northeast Junior High</td>
<td>8</td>
</tr>
<tr>
<td>Oakleigh Middle</td>
<td>2</td>
</tr>
<tr>
<td>Riverside Junior High</td>
<td>7</td>
</tr>
<tr>
<td>West Middle</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>
Figure 1. Location of Junior High/Middle Schools within the Grand Rapids Public School System.
Assumptions and Definitions

The following assumptions and definitions served as benchmarks for the conduct of the study and the conclusions and recommendations that emerged.

Assumptions

1. Junior-high/middle-school science teachers have unique inservice needs, experiences and perceptions that can be identified.
2. The instruments developed for this study are defensible for gaining the desired information.
3. Junior-high/middle-school science teachers are professionals with sufficient interest in the profession to respond carefully to the questionnaires.

Definitions

1. Junior-high/middle-school science teacher--an instructor of science in grades 7, 8 or 9 or any combination of these grades.
2. Inservice-education strategy--a plan of activities and programs designed to contribute to both upgrading in competence and professional growth of the junior-high/middle-school science teacher.
3. Development of an inservice-education strategy--the design and planning of programs and activities.

Summary

The purpose of this chapter was to detail the research design for this study. This design included data-collection and data-analysis.
procedures, a description of the population as well as lists of assumptions and definitions. A summary of the data is presented in Chapter III.
CHAPTER III - FINDINGS

Introduction

In order to present a specific strategy for the inservice education of junior-high/middle-school science teachers in the Grand Rapids Public School System, the following information was sought:

1. General characteristics of teachers in the sample, including (a) undergraduate major, (b) undergraduate minor, (c) level of certification, (d) years of teaching experience, (e) course assignment, (f) grade assignment, and (g) preferred grade assignment.

2. Inservice-education background of teachers in the sample, including (a) graduate education, (b) science-education course work, (c) most recent inservice experiences, (d) membership in professional associations, (e) participation in professional activities, and (f) journal subscriptions.

3. Perceived inservice-education needs of teachers in the sample.

4. Guidelines elicited from a review of the literature for planning inservice-education programs and activities. These guidelines consider the following parameters of inservice education: (a) purposes of inservice education, (b) levels of organization of inservice programs, (c) formats of inservice programs, (d) topics for inservice programs, (e) teacher's roles in inservice programs, (f) people/organizations who influence inservice education, (g) locations for inservice programs, (h) frequency in conducting inservice programs, and (i) times when inservice programs are scheduled.

5. Perceptions of teachers in the sample concerning those
parameters listed above.

Responses to the Questionnaires

Of the 48 junior-high/middle-school science teachers in the Grand Rapids Public School System, 39 responded to the Science Teacher Needs Assessment and 35 to the Professional Development Survey. These represent responses of 81% and 73% respectively. The numbers of respondents are listed by school in Table 2.

Table 2
Number of Teachers Responding to Each Questionnaire

<table>
<thead>
<tr>
<th>School</th>
<th>Number of Responses to Needs Assessment</th>
<th>Number of Responses to Professional Development Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burton Junior High</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>City Junior High</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Educational Park</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Harrison Junior High</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Iroquois Middle</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Northeast Junior High</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Oakleigh Middle</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Riverside Junior High</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>West Middle</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>35</td>
</tr>
</tbody>
</table>

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These findings show that responses were received from all but one school in the sample. There is no validated reason why the one teacher from City Junior High School did not respond to either questionnaire. But, comparison of these findings with those in Table 1 indicates that all schools were well represented, with the exception of Northeast Junior High School. A possible explanation for the lack of response from Northeast Junior High School is that they had no representative at the initial meetings or on the steering committee.

**General Characteristics of the Teacher Sample**

The items contained in the section, General Information, of the Professional Development Survey, were designed to determine those characteristics of the junior-high/middle-school science teacher that would help to determine the nature and extent of inservice-education programs and activities. Responses to these items are summarized in Table 3.

An analysis of the data in Table 3 indicates that a large percentage of the sample:

1. Have an undergraduate major in biology (49%).
2. Do not have an undergraduate major in the physical sciences (physics and chemistry) (89%).
3. Have undergraduate minors in non-science fields (63%).
4. Hold secondary teacher certificates (77%).
5. Have taught seven years or more (50%).
6. Teach only science (77%).
7. Teach primarily junior-high/middle-school level (98%).
Table 3

General Characteristics of Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System

<table>
<thead>
<tr>
<th>Undergraduate academic major</th>
<th>Biology</th>
<th>49%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemistry</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Physics</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Earth Science</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>29%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undergraduate academic minor</th>
<th>Biology</th>
<th>11%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemistry</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Physics</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>Earth Science</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>63%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of teaching certificate</th>
<th>K-12</th>
<th>14%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K-8</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>7-12</td>
<td>77%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of teaching experience</th>
<th>Less than 1</th>
<th>2%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-3</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>4-6</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>7-9</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>10-12</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>More than 12</td>
<td>18%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Courses being taught</th>
<th>Science only</th>
<th>77%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other</td>
<td>23%</td>
</tr>
</tbody>
</table>

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Table 3 - Continued

<table>
<thead>
<tr>
<th>Primary grade level being taught</th>
<th>7</th>
<th>38%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>10-12</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preferred teaching level</th>
<th>7</th>
<th>29%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>10-12</td>
<td>42%</td>
</tr>
</tbody>
</table>

8. Prefer to teach at the high-school level (42%).

Inservice-Education Background of the Teacher Sample

The items contained in the section, Inservice Education Experience, of the Professional Development Survey, were designed to determine certain aspects of previous inservice training, experienced by the sample of teachers. This information would then be used to determine the nature and extent of inservice-education programs and activities. Responses to these items are summarized in Table 4.

The data in Table 4 indicate that a large percentage of the sample:

1. Hold at least master's degrees (57%).
2. Have not taken a science or science-education course in the past four years (54%).
3. Have not participated in an inservice activity related to their science teaching within the last year (63%).

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Table 4

Inservice-Education Background
of Junior-High/Middle-School Science Teachers
in the Grand Rapids Public School System

<table>
<thead>
<tr>
<th>Highest level of education completed</th>
<th>Bachelor's</th>
<th>Bachelor's plus</th>
<th>Master's</th>
<th>Master's plus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6%</td>
<td>37%</td>
<td>34%</td>
<td>23%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most recent science or science education course taken for credit</th>
<th>Less than 1 year ago</th>
<th>1-3 years ago</th>
<th>4-6 years ago</th>
<th>More than 6 years ago</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23%</td>
<td>23%</td>
<td>23%</td>
<td>31%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most recent inservice activity related to science teaching</th>
<th>Less than 1 year ago</th>
<th>1-3 years ago</th>
<th>4-6 years ago</th>
<th>More than 6 years ago</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>37%</td>
<td>46%</td>
<td>6%</td>
<td>2%</td>
<td>9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Format of activity referred to above</th>
<th>Continuing education course</th>
<th>Workshop</th>
<th>Conference/convention</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9%</td>
<td>67%</td>
<td>15%</td>
<td>9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Membership in science teachers association</th>
<th>National Science Teachers Association (NSTA)</th>
<th>Michigan Science Teachers Association (MSTA)</th>
<th>Other</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17%</td>
<td>14%</td>
<td>6%</td>
<td>74%</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Professional activities</th>
<th>National Science Foundation Institute</th>
<th>14%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>National Science Teachers Association Convention</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Michigan Science Teachers Association Convention</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>A local science curriculum committee</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>None of the above</td>
<td>48%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional journal subscription?</th>
<th>Yes</th>
<th>29%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>71%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reason for previous participationa</th>
<th>Professional growth</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Job promotion</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Salary increase</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Administrative pressure</td>
<td>1.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of previous inservice experiencesb</th>
<th>Educational</th>
<th>21%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Worthwhile</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>Relevant</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Applicable</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Not timely</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Irrelevant</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Timely</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Wasteful</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Not applicable</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Nongeducational</td>
<td>5%</td>
</tr>
</tbody>
</table>

*a* Respondents were asked to rate these "reasons" on a three-point scale. Scores ranged from 1.0 to 3.0, from unimportant to very important. Mean scores are based on N = 39.

*b* Respondents could check more than one word.
4. Have participated in a workshop as their most recent inservice activity (67%).

5. Are not members of any science-teacher professional associations (74%).

6. Have never participated in an NSF institute (86%).

7. Have never attended an NSTA convention (94%).

8. Have never attended an MSTA convention (69%).

9. Have never participated on a science curriculum committee (52%).

10. Do not subscribe to professional science teaching journals (71%).

The data from Table 4 also indicate that:

1. "Professional growth" is an important reason for teachers having participated in previous inservice activities.

2. Words such as, "educational," "worthwhile," "relevant," and "applicable," best describe teachers' previous inservice experience.

**Perceived Inservice-Education Needs of the Teacher Sample**

The items contained in the Needs Assessment were designed to determine specific inservice-education needs as perceived by the sample. The rating of those needs helped to establish objectives for planning inservice-education programs and activities. Each need was rated by each respondent on a four-point scale with the 4.0 rating being "much need" and the 1.0 rating being "no need." Based on total responses, a mean value was determined for each need. Any need that had a mean value between 3.0 (moderate need) and 4.0 (much need) was considered critical. Table 5 lists those needs that teachers perceived to be of

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critical importance together with their mean values. Any need that had a mean value between 2.0 (slight need) and 3.0 (moderate need) was considered moderate. Table 6 lists those needs that teachers perceived to be of moderate importance together with their mean values. Any need that had a mean value between 1.0 (no need) and 2.0 (slight need) was considered slight. Table 7 lists those needs that teachers perceived to be of slight importance together with their mean values.

Table 5

Inservice-Education Needs that Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System Perceived to be of Critical Importance

<table>
<thead>
<tr>
<th>Need</th>
<th>( \bar{x} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing science teaching ideas with other science teachers.</td>
<td>3.3</td>
</tr>
<tr>
<td>Designing laboratory activities for more effective science instruction.</td>
<td>3.3</td>
</tr>
<tr>
<td>Designing demonstrations for more effective science instruction.</td>
<td>3.2</td>
</tr>
<tr>
<td>Adapting the science curriculum to the appropriate achievement levels of the students.</td>
<td>3.2</td>
</tr>
<tr>
<td>Organizing science curriculum materials for more effective instruction.</td>
<td>3.0</td>
</tr>
<tr>
<td>Effectively evaluating and testing students' attainment of the course objectives.</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Note. \( N = 39 \).

\( ^a \) Need was considered critical if, \( 3.0 \leq \bar{x} \leq 4.0 \). (1.0 \( \leq x \leq 4.0 \)
<table>
<thead>
<tr>
<th>Need</th>
<th>$\bar{x}^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtaining supplementary science books for students on appropriate</td>
<td>2.9</td>
</tr>
<tr>
<td>grade levels.</td>
<td></td>
</tr>
<tr>
<td>Adapting the science curriculum to individual needs.</td>
<td>2.9</td>
</tr>
<tr>
<td>Finding places for field trips where natural physical principles can</td>
<td>2.9</td>
</tr>
<tr>
<td>be illustrated (quarries, weather stations, etc.).</td>
<td></td>
</tr>
<tr>
<td>Overcoming difficulties encountered in providing field trips outside</td>
<td>2.9</td>
</tr>
<tr>
<td>the classroom (locating suitable places, transportation, approval,</td>
<td></td>
</tr>
<tr>
<td>funds, etc.).</td>
<td></td>
</tr>
<tr>
<td>Obtaining information on your students' attitudes, needs, and</td>
<td>2.8</td>
</tr>
<tr>
<td>interests in science.</td>
<td></td>
</tr>
<tr>
<td>Effectively evaluating your students' knowledge of science in</td>
<td>2.8</td>
</tr>
<tr>
<td>general.</td>
<td></td>
</tr>
<tr>
<td>Obtaining information on how the course objectives relate to science</td>
<td>2.7</td>
</tr>
<tr>
<td>education in the elementary and senior high school.</td>
<td></td>
</tr>
<tr>
<td>Obtaining and utilizing community resources (speakers, field trips,</td>
<td>2.7</td>
</tr>
<tr>
<td>etc.).</td>
<td></td>
</tr>
<tr>
<td>Establishing and maintaining adequate safety conditions in the</td>
<td>2.7</td>
</tr>
<tr>
<td>laboratory.</td>
<td></td>
</tr>
<tr>
<td>Finding places for field trips where applied physical principles can</td>
<td>2.7</td>
</tr>
<tr>
<td>be illustrated (airports, factories, etc.).</td>
<td></td>
</tr>
<tr>
<td>Effectively using the &quot;activities&quot; in the modules to teach course</td>
<td>2.6</td>
</tr>
<tr>
<td>objectives.</td>
<td></td>
</tr>
<tr>
<td>Updating of present knowledge in Physics.</td>
<td>2.6</td>
</tr>
<tr>
<td>Need</td>
<td>$\chi^a$</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Effectively utilizing the textbooks, Focus on Science$^b$, teacher's manual, supplementary materials, etc.</td>
<td>2.6</td>
</tr>
<tr>
<td>Establishing and maintaining adequate safety conditions in the classroom.</td>
<td>2.6</td>
</tr>
<tr>
<td>Effectively integrating the Focus on Science$^b$ modules with the course objectives.</td>
<td>2.6</td>
</tr>
<tr>
<td>Obtaining information on your students' prior achievement in science.</td>
<td>2.5</td>
</tr>
<tr>
<td>Updating of present knowledge of content in Chemistry.</td>
<td>2.4</td>
</tr>
<tr>
<td>Preparing instructional materials for enrichment.</td>
<td>2.4</td>
</tr>
<tr>
<td>Establishing and maintaining adequate safety conditions on field trips.</td>
<td>2.4</td>
</tr>
<tr>
<td>Updating of present knowledge of content in Biology.</td>
<td>2.3</td>
</tr>
<tr>
<td>Preparing instructional materials for general classroom use.</td>
<td>2.3</td>
</tr>
<tr>
<td>Developing long range units of work.</td>
<td>2.3</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Matter and Change.&quot;$^c$</td>
<td>2.3</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Energy.&quot;$^c$</td>
<td>2.3</td>
</tr>
<tr>
<td>Obtaining and utilizing audio-visual materials as instructional media.</td>
<td>2.3</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Health.&quot;$^c$</td>
<td>2.3</td>
</tr>
<tr>
<td>Updating of present knowledge in Mathematics.</td>
<td>2.3</td>
</tr>
<tr>
<td>Need</td>
<td>( \bar{x}^a )</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Changing Earth.&quot; (^c)</td>
<td>2.3</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Physics.&quot; (^c)</td>
<td>2.2</td>
</tr>
<tr>
<td>Updating of present knowledge of content in Earth Science.</td>
<td>2.2</td>
</tr>
<tr>
<td>Utilizing the library and its facilities to supplement science instruction.</td>
<td>2.2</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Ecology and Conservation.&quot; (^c)</td>
<td>2.2</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Astronomy.&quot; (^c)</td>
<td>2.2</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Atmosphere.&quot; (^c)</td>
<td>2.2</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Human Body.&quot; (^c)</td>
<td>2.2</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;How Scientists Work.&quot; (^c)</td>
<td>2.2</td>
</tr>
<tr>
<td>Meeting the objectives in the unit: &quot;Life Science.&quot; (^c)</td>
<td>2.1</td>
</tr>
<tr>
<td>Developing daily lesson plans.</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Note. \( N = 39 \).

\(^a\) Need was considered moderate if, \( 2.0 \leq \bar{x} \leq 3.0 \). (1.0 \leq \bar{x} \leq 4.0)

\(^b\) Adopted textbook for the Grand Rapids Public School System.

\(^c\) Recommended units in the Grand Rapids Public School System.

As explained in Chapter II, items in the Science Teacher Needs
Table 7

Inservice-Education Needs that Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System Perceived to be of Slight Importance

<table>
<thead>
<tr>
<th>Need</th>
<th>$\bar{x}^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidance and assistance in science teaching from the local university or college.</td>
<td>1.9</td>
</tr>
<tr>
<td>Guidance and assistance in science teaching from the science supervisor.</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Note. $N = 39$.

$^a$Need was considered slight if $1.0 \leq \bar{x} \leq 2.0$. ($1.0 \leq \bar{x} \leq 4.0$)

Assessment were designed on the basis of six major categories. The need in each category that emerged with the highest mean value was also considered to be of critical importance. The list of those critical needs, their respective categories, and their mean values appear in Table 8. Comparing the needs in Table 8 with Table 5 indicates that four additional critical needs were identified.

Summary of Science Teacher Needs Assessment

The needs perceived by the teachers in this sample to be critical (see Table 5 and Table 8) can be summarized as follows:

1. Sharing teaching ideas.
2. Designing laboratory activities and demonstrations.
3. Adapting, organizing, and obtaining science curriculum materials.
4. Evaluating and testing course objectives.
Table 8
Inservice-Education Need Within Each Category that Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System Perceived to be Critical

<table>
<thead>
<tr>
<th>Category</th>
<th>Need</th>
<th>( \bar{x}^a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of a better understanding of students</td>
<td>Obtaining information on your students' attitudes, needs, interests.</td>
<td>2.8</td>
</tr>
<tr>
<td>Improvement of diagnosis and evaluation practices</td>
<td>Effectively evaluating and testing students attainment of course objectives.</td>
<td>3.0</td>
</tr>
<tr>
<td>Development of better classroom management practices</td>
<td>Establishing and maintaining adequate safety conditions in the laboratory.</td>
<td>2.7</td>
</tr>
<tr>
<td>Improvement of classroom instruction and planning</td>
<td>Sharing science teaching with other science teachers.</td>
<td>3.3</td>
</tr>
<tr>
<td>More effective use of instructional materials</td>
<td>Obtaining supplementary science books for students on appropriate grade levels.</td>
<td>2.9</td>
</tr>
<tr>
<td>Self-improvement of the classroom science teacher</td>
<td>Updating of present knowledge in Physics.</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Note. \( N = 39 \).

\( (1.0 \leq \bar{x} \leq 4.0) \)

5. Assessing students' attitudes, needs, and interests.
6. Establishing and maintaining a safe laboratory.
7. Updating in physics.
A close analysis of these needs is imperative for the development of an effective inservice-education strategy. These needs must be incorporated into the objectives, formats, and topics of inservice-education programs that are planned, if such programs are to be useful.

The 38 needs perceived to be moderate by the sample (see Table 6) can be summarized as follows:

1. Those related to improving the curriculum.
2. Those related to implementing field trips.
3. Those related to meeting course objectives.
4. Those related to updating in subject-matter.

Although these needs are perceived to be of moderate importance, those rated near the top of the list should definitely be considered in planning additional inservice-education programs.

The two needs perceived by the sample to be of slight importance (see Table 7) both deal with guidance and assistance from sources outside the local school.

Guidelines and Perceptions for Planning Inservice-Education Programs and Activities

Data in this section were obtained from (a) a review of current literature, and (b) responses to items in the section, Perceptions of Inservice Education, of the Professional Development Survey. Both of these sources provided guidelines for planning specific programs and activities for junior-high/middle-school science teachers in the Grand Rapids Public School System.

Findings elicited from the literature, presented below, were obtained from the following sources:


5. A review and summary of 97 studies and evaluation reports of inservice education (Lawrence, 1974).


9. A summary of a workshop in which 87 educators attempted to reconceptualize inservice education (Edelfelt and Johnson, 1975).

10. A study that surveyed 475 science teachers in Michigan concerning their preservice and inservice education (Faber, 1974).

These sources were selected because all included suggestions and recommendations, based on current research, that could be applied to the planning of programs and activities as part of an inservice-education strategy.

Responses to items in the section, Perceptions of Inservice Education, of the Professional Development Survey, are presented in Tables...
9-19. For each item, respondents rated the choices on a three-point scale with 3.0 being "very appropriate" or "very important" and 1.0 being "inappropriate" or "unimportant." Based on total responses, a mean value was calculated for each choice. The choices were then ranked, in ascending order, based on their mean values. Choices with mean values between 2.0 and 3.0 were considered to be appropriate or important whereas those with mean values between 1.0 and 2.0 were considered to be inappropriate or unimportant.

Findings from both the literature review and responses to the Professional Development Survey are summarized and combined into the categories listed below.

1. The purposes of inservice education.
2. The levels of organization for inservice-education programs and activities.
3. The formats for inservice-education programs and activities.
4. The topics of inservice-education programs and activities.
5. The roles of the teacher in inservice-education programs and activities.
6. The people/organizations that influence inservice-education.
7. The locations for inservice-education programs and activities.
8. The frequency in conducting inservice-education programs and activities.
9. The times when inservice-education programs and activities are scheduled.
Purposes of Inservice Education

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed important to recognize both general and specific purposes of inservice education. Enumerating the purposes of inservice education would help not only in planning inservice programs but also in evaluating the outcome of those programs.

Literature Review

A review of the literature with respect to the purposes of inservice education, elicited the following guidelines:

1. Teachers are more likely to benefit from inservice education activities that are linked to a general effort of the school than they are from "single-shot" programs that are not part of a general staff development plan (Lawrence, 1974, p. 15).

2. Inservice-education programs in which teachers share and provide mutual assistance to each other are more likely to accomplish their objectives than are programs in which each teacher works independently (Lawrence, 1974, p. 15).

3. The objectives of an inservice program should be specific teaching performances or outcomes (Western Washington State College Monograph, 1977, p. 4).


5. Inservice education should be based on personnel needs/school program needs/student needs (Edelfelt and Johnson, 1975, p. 72-74).

6. Inservice education should interface with curriculum development
and instructional improvement (Edelfelt and Johnson, 1975, p. 72-74).

7. The primary purpose of inservice education is to improve upon the instructional process (Anderson, 1979, p. 9).

Thus, it is apparent that purposes of inservice education should be based on the needs of teachers, students, and school programs. Also, purposes of inservice education should be in accord with school goals and plans. Purposes (objectives) of specific programs should be clearly delineated and deal with teaching performances and outcomes. Purposes of inservice education should include developing curriculum and improving instruction.

Teachers' Perceptions

Teachers in the sample were asked to rate the appropriateness of certain purposes of inservice education for science teachers. The results are summarized in Table 9.

The values of the mean scores in Table 9 show that all four suggested purposes were perceived by the sample to be appropriate.

Levels of Organization for Inservice-Education Programs and Activities

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed important to determine levels of organization on which programs and activities could be planned.

Literature Review

A review of the literature with respect to the levels of organization

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Table 9
The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Some Purposes of Inservice Education

<table>
<thead>
<tr>
<th>Purposes</th>
<th>$\bar{x}^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing teaching methods</td>
<td>2.8</td>
</tr>
<tr>
<td>Updating in content</td>
<td>2.6</td>
</tr>
<tr>
<td>Implementing curriculum</td>
<td>2.4</td>
</tr>
<tr>
<td>Choosing curriculum</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Note. $N = 34$.

$^a$Mean values range from 1.0 to 3.0, with $\bar{x} \geq 2.0$ corresponding to appropriate purposes.

of inservice-education programs, elicited the following guidelines:

1. Effective inservice programs must be initiated locally and adapted to specific needs (NSTA, 1978, p. 27).

2. There is a greater preference for inservice meetings organized and arranged for teachers of similar grades, disciplines, or programs, than those arranged for all teachers without regard to their grades or disciplines (Ngaiyaye and Hanley, 1978, p. 305-310).

Thus, it is apparent that inservice-education programs should be organized locally and, more specifically, be organized for teachers with similar teaching assignments. Also, adjustments should be made to accommodate new teachers as well as "old hands".
Teachers' Perceptions

Teachers in the sample were asked to rate the appropriateness of certain levels of organization at which inservice education for science teachers should be conducted. The results are summarized in Table 10.

Table 10

The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Organizational Levels for Inservice-Education Programs and Activities

<table>
<thead>
<tr>
<th>Organizational levels</th>
<th>$\bar{x}^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building/Department</td>
<td>2.3</td>
</tr>
<tr>
<td>Individualized</td>
<td>2.2</td>
</tr>
<tr>
<td>System wide</td>
<td>2.2</td>
</tr>
<tr>
<td>County wide</td>
<td>1.6</td>
</tr>
<tr>
<td>Statewide</td>
<td>1.6</td>
</tr>
<tr>
<td>Nationwide</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Note. N = 34.

$^a$Mean values range from 1.0 to 3.0, with $\bar{x} \geq 2.0$ corresponding with appropriate levels of organization.

The mean values in Table 10 show that three of the six levels of organization were perceived by the teachers in the sample to be appropriate. It is interesting to note that those three levels of organization are the ones on the list that are most localized.

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Formats for Inservice-Education Programs and Activities

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed important to determine appropriate formats or types of activities for programs.

Literature Review

A review of the literature with respect to formats of inservice-education programs and activities, elicited the following guidelines:

1. Inservice-education programs that have differentiated training experiences for different teachers (that is individualized) are more likely to accomplish their objectives than are programs that have common activities for all participants (Lawrence, 1974, p. 14).

2. Inservice programs that emphasize demonstrations, supervised trials and feedback are more likely to accomplish their goals than are programs in which teachers are expected to store up ideas and behavior prescriptions for future time (Lawrence, 1974, p. 14).

3. Instructors prefer workshops most, and conventions least, when expressing an inservice preference (Anderson, 1979, p. 15).

4. A sample of educators rated these formats in order of preference: (a) Workshops, (b) Demonstrations, (c) Seminars, (d) Institutes, (e) Conferences, and (f) Conventions (Anderson, 1979, p. 4).

5. A sample of junior-high science teachers rated these as most beneficial inservice formats: (a) Workshops in Science Methods, (b) Share Sessions with other Teachers, (c) Inter-School Visitation, (d) Workshops for Updating Academic Background, and (e) NSF Institutes (Faber, 1974, p. 59).
These guidelines show that inservice-education programs should be planned with a variety of formats. These formats should include (a) individualized experiences, (b) demonstrations, (c) workshops, (d) visits, and (e) seminars. Also, formats such as conferences and conventions were among the least preferred by teachers.

Teachers' Perceptions

Teachers in the sample were asked to rate the appropriateness of certain formats for inservice programs and activities for science teachers. The results are summarized in Table 11.

The mean values show that seven of the eight formats presented, were perceived by the sample to be appropriate. It appears that teachers in the sample show preference for a variety of formats.

Topics for Inservice-Education Programs

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed important to determine appropriate topics for programs and activities being planned.

Literature Review

A review of the literature with respect to topics for inservice-education programs and activities, elicited the following guidelines:

1. The needs of teachers must directly influence the nature and design of inservice education programs (Wilen and Kindsvatter, 1978, p. 394).

2. For inservice topics, it may be more beneficial to emphasize
Table 11

The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Formats for Inservice-Education Programs and Activities

<table>
<thead>
<tr>
<th>Formats</th>
<th>$\bar{x}^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshops with high participant involvement</td>
<td>2.5</td>
</tr>
<tr>
<td>Demonstration lessons by other science teachers</td>
<td>2.4</td>
</tr>
<tr>
<td>Visits to other programs</td>
<td>2.4</td>
</tr>
<tr>
<td>College/University courses for credit</td>
<td>2.3</td>
</tr>
<tr>
<td>Time to attend conferences and/or conventions</td>
<td>2.3</td>
</tr>
<tr>
<td>Seminars offered by knowledgeable people</td>
<td>2.1</td>
</tr>
<tr>
<td>Sabbatical leave of absence</td>
<td>2.0</td>
</tr>
<tr>
<td>Newsletters and other publications</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Note. $N$ = 35.

$^a$Mean values range from 1.0 to 2.0 with $\bar{x} \geq 2.0$ corresponding to appropriate formats.

practice rather than theory. Teachers are looking for the practical and concrete ideas; for the answers to the "how to" rather than the theory behind education (Ngaiyaye and Hanley, 1978, pp. 305-310).

3. One of the most motivating inservice activities is an opportunity to become acquainted with new teaching practices or innovative programs (Anderson, 1979, p. 9).

4. Opportunities must be expanded and made available on a continuing basis so that science teachers will be informed as new knowledge

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in the sciences becomes available, research on methods of science teaching produce new techniques, and new curriculum materials are developed (NSTA, 1978, p. 26).

5. As a result of the development of many new instructional programs in science during the past two decades, much inservice activity has been needed for successful implementation and adaptation to local needs (NSTA, 1978, p. 27).

These guidelines indicate that topics for inservice-education programs and activities should be generated by teacher needs. Also, topics should emphasize practical ideas. Topics should be related to such teaching practices as implementing new programs.

Teachers' Perceptions

Teachers in the sample were asked to rate the appropriateness of certain topics for inservice education of science teachers. The results are summarized in Table 12.

The mean values show that all five topics, presented, were perceived by the sample to be appropriate for inservice-education programs and activities. These topics are similar to those critical needs that emerged from the Science Teacher Needs Assessment (see Tables 5 and 8).

Teacher's Roles in Inservice-Education Programs and Activities

In presenting a strategy for the inservice education of the junior-high/middle-school science teacher it was deemed important to determine the appropriate roles that teachers play in programs and activities.
Table 12
The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Certain Topics for Inservice-Education Programs and Activities

<table>
<thead>
<tr>
<th>Topics</th>
<th>$\bar{x}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updating in science content</td>
<td>2.6</td>
</tr>
<tr>
<td>Recent discoveries in science</td>
<td>2.5</td>
</tr>
<tr>
<td>Science teaching methods</td>
<td>2.5</td>
</tr>
<tr>
<td>Science curriculum development</td>
<td>2.3</td>
</tr>
<tr>
<td>Testing/Evaluating objectives</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Note. $N = 34$.

$^a$Mean values range from 1.0 to 3.0 with $\bar{x} > 2.0$ corresponding to appropriate topics.

**Literature Review**

A review of the literature with respect to teacher's roles in inservice programs and activities, elicited the following guidelines:

1. Teachers need to be involved directly in planning the goals, content, and instructional approach of inservice education programs (Wilen and Kindsvatter, 1978, p. 394).

2. Inservice programs that place teachers in an active role (constructing and generating materials, ideas, etc.) are more likely to accomplish their objectives than are programs that place the teacher in a receptive role (Lawrence, 1974, p. 14).
3. Teachers are more likely to benefit from inservice programs in which they can choose goals and activities for themselves, as contrasted with programs in which goals and activities are preplanned (Lawrence, 1974, p. 15).

4. Instructors need to be involved in the developing of purposes, activities, and methods of evaluation for inservice programs (Anderson, 1979, p. 9).

These guidelines show that there is a variety of roles teachers should play in inservice-education programs and activities. Most of these guidelines suggest active rather than passive roles for the teacher.

**Teachers' Perceptions**

Teachers in the sample were asked to rate the appropriateness of certain roles for the science teacher in inservice activities. The results are summarized in Table 13.

The mean values show that three of the four roles presented, were perceived by the sample to be appropriate in inservice-education programs and activities.

**People/Organizations that Influence Inservice Education**

In presenting a strategy for the inservice education of the junior-high/middle-school science teacher it was deemed important to identify appropriate people and/or organizations that should and do influence programs and activities.
Table 13

The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Roles for Teachers in Inservice-Education Programs and Activities

<table>
<thead>
<tr>
<th>Roles</th>
<th>(\bar{x})^a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active participant</td>
<td>2.5</td>
</tr>
<tr>
<td>Evaluator</td>
<td>2.2</td>
</tr>
<tr>
<td>Planner/Organizer</td>
<td>2.0</td>
</tr>
<tr>
<td>Presenter</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Note. \(N = 35\).

^a Mean values range between 1.0 and 3.0 with \(\bar{x} \geq 2.0\) corresponding to appropriate roles.

Literature Review

A review of the literature with respect to people/organizations that influence inservice education, elicited the following guidelines:

1. Science coordinators and consultants in local school districts are important in planning, initiating, conducting and following up inservice programs (NSTA, 1978, p. 28).

2. State science supervisors play an important role in inservice education (NSTA, 1978, p. 28).

3. Science educators at local colleges and universities are individuals valuable for providing inservice education (NSTA, 1978, p. 29).
4. Area colleges and universities should serve as a major source for inservice program directors and consultants (Wilen and Kindsvatter, 1978, p. 394).

5. Adequate personnel are available from school districts and colleges/universities for inservice education (Edelfelt, 1976).

These guidelines indicate that there are certain people and organizations that influence inservice education.

**Teachers' Perceptions**

Teachers in the sample were asked to rate the degree of influence that certain people/organizations should have on science-teacher inservice education. The results are summarized in Table 14. Also, these teachers were asked to rate the degree of influence that these same people/organizations do have on inservice education. These results are summarized in Table 15, page 65.

The mean values in Table 14 show that only two people, the science supervisor and the science department head, should have any influence on inservice education, whereas mean values in Table 15 show that only one person, the science supervisor, is perceived by teachers in the sample to actually have any influence on inservice education.

**Location for Inservice-Education Programs and Activities**

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed important to determine appropriate locations for conducting programs and activities.

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Table 14
The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of People/Organizations that Should Influence Inservice-Education

<table>
<thead>
<tr>
<th>People/Organizations</th>
<th>$\bar{x}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science supervisor</td>
<td>2.4</td>
</tr>
<tr>
<td>Science department head</td>
<td>2.3</td>
</tr>
<tr>
<td>Professional science teacher associations (i.e. NSTA)</td>
<td>1.9</td>
</tr>
<tr>
<td>University science educators</td>
<td>1.7</td>
</tr>
<tr>
<td>State Department of Education</td>
<td>1.6</td>
</tr>
<tr>
<td>Building administration</td>
<td>1.4</td>
</tr>
<tr>
<td>Local bargaining association (i.e. GREA)</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Note. $N = 34$.

$^a$Mean values range from 1.0 to 3.0 with $\bar{x} \geq 2.0$ corresponding with appropriate people/organizations.

Literature Review

A review of the literature with respect to locations for inservice-education programs and activities, elicited the following guidelines:

1. Inservice education cannot be imposed by either internal or external groups and cannot consist of one session at some center on campus (NSTA, 1978, p. 29).  
2. School-based inservice programs concerned with teacher behaviors tend to have greater success in accomplishing their objectives...
Table 15
The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of People/Organizations that Do Influence Inservice-Education

<table>
<thead>
<tr>
<th>People/Organizations</th>
<th>$\bar{x}^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science supervisor</td>
<td>2.0</td>
</tr>
<tr>
<td>Science department head</td>
<td>1.8</td>
</tr>
<tr>
<td>Building administration</td>
<td>1.7</td>
</tr>
<tr>
<td>University science educators</td>
<td>1.6</td>
</tr>
<tr>
<td>Professional science teacher associations (i.e. NSTA)</td>
<td>1.6</td>
</tr>
<tr>
<td>State Department of Education</td>
<td>1.4</td>
</tr>
<tr>
<td>Local bargaining association</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Note. $N = 34$.

$^a$Mean values range from 1.0 to 3.0 with $\bar{x} \geq 2.0$ corresponding to appropriate people/organizations.

than do college-based programs (Lawrence, 1974, p. 9).

3. Teacher attitudes are more likely to be influenced in school-based than in college-based programs (Lawrence, 1974, p. 9).

Although these guidelines do not speak directly to specific locations for conducting inservice-education programs and activities, they do imply that programs should be held in local school settings as opposed to college settings.
Teachers' Perceptions

Teachers in the sample were asked to rate the appropriateness of certain locations for holding inservice-education meetings. The results are summarized in Table 16.

Table 16

The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Locations for Holding Inservice-Education Programs and Activities

<table>
<thead>
<tr>
<th>Locations</th>
<th>$\bar{x}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local school</td>
<td>2.5</td>
</tr>
<tr>
<td>Local college/university</td>
<td>2.4</td>
</tr>
<tr>
<td>A noneducational setting</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Note. $N = 34$.

$^a$Mean values range from 1.0 to 3.0 with $\bar{x} \geq 2.0$ corresponding to appropriate locations.

Mean values show that both a local school and a local college/university are perceived by the sample to be appropriate locations for holding inservice-education meetings.

Frequency in Conducting Inservice-Education Programs

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed important to determine the appropriate frequencies of conducting inservice-education
programs and activities.

**Literature Review**

A review of the literature with respect to the frequency of having inservice-education programs and activities, elicited the following guidelines:

1. Opportunities must be expanded and made available on a continuing basis so that science teachers will be informed as new knowledge in the sciences becomes available, research on methods of science teaching produces new techniques, and new curriculum materials are developed (NSTA, 1978, p. 26).

2. Growth and development require continuous articulated opportunities that have been planned and organized around the needs of the participants (NSTA, 1978, p. 27).

3. More time has to be set aside for staff development--time for planning and carrying out initial staff development activities and for planning follow-up activities that help teachers extend and apply what they have learned (Zigarmi, Betz, and Jensen, 1977, p. 551).

Although these guidelines do not indicate directly the appropriate frequency for inservice-education programs, they do imply that programs should be conducted on a continuous basis.

**Teachers' Perceptions**

Teachers in the sample were asked to rate the appropriateness of frequencies for participating in inservice-education activities for science teachers. The results are summarized in Table 17.
Table 17
The Ratings by Junior-High/Middle-School Science Teachers in the Grand Rapids Public School System of Frequencies for Participating in Inservice-Education Programs

<table>
<thead>
<tr>
<th>Frequencies</th>
<th>$\bar{x}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a semester</td>
<td>2.2</td>
</tr>
<tr>
<td>Once a year</td>
<td>1.7</td>
</tr>
<tr>
<td>Monthly</td>
<td>1.6</td>
</tr>
<tr>
<td>A week or two in the summer</td>
<td>1.6</td>
</tr>
<tr>
<td>Weekly</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note. $N = 33$.

$^a$Mean values range from 1.0 to 3.0 with $\bar{x} \geq 2.0$ corresponding to appropriate frequencies.

The mean values show that only one frequency was perceived by teachers in the sample to be appropriate for participating in inservice-education programs and activities. That frequency is once a semester. This seems inconsistent with the guidelines that indicate that inservice education should be on a continuous basis.

Time When Inservice-Education Programs are Scheduled

In presenting a strategy for the inservice education of junior-high/middle-school science teachers it was deemed appropriate to determine appropriate times for scheduling programs and activities.
Literature Review

A review of the literature with respect to times for scheduling inservice-education programs and activities, elicited the following guidelines:

1. Teachers must be allowed more time for inservice education during the school day (NSTA, 1978, p. 27).

2. Inservice education programs should be held during the regular school day when possible and when not, teachers should be financially compensated for their participation (Wilen and Kindsvatter, 1978, p. 395).

3. Training related to job assignments is most effective if adequate time is provided within the current work schedule for each activity (Western Washington State College Monograph, 1977, p. 5).

These guidelines indicate that some time should be made available during the school day for scheduling inservice-education programs and activities.

Teachers' Perceptions

Teachers in the sample were asked to rate the appropriateness of certain times for participating in inservice-education activities. The results are summarized in Table 18.

The mean values indicate that released time during school is the only time perceived by teachers in the sample to be appropriate for participating in inservice-education programs.
Table 18
The Ratings by Junior-High/Middle-School Science Teachers in The Grand Rapids Public School System of Times for Participating in Inservice-Education Programs and Activities

<table>
<thead>
<tr>
<th>Time</th>
<th>( \bar{x}^a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>During school (released time)</td>
<td>2.6</td>
</tr>
<tr>
<td>Immediately after school</td>
<td>1.8</td>
</tr>
<tr>
<td>Summers</td>
<td>1.6</td>
</tr>
<tr>
<td>Evenings</td>
<td>1.3</td>
</tr>
<tr>
<td>Before school</td>
<td>1.2</td>
</tr>
<tr>
<td>Weekends</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Note. \( N = 34. \)

\(^a\)Mean values range from 1.0 to 3.0 with \( \bar{x} \geq 2.0 \) corresponding to appropriate times.

Summary

It is evident from the findings that many factors need to be considered in presenting a strategy for the inservice education of junior-high/middle-school science teachers. These factors range from the general characteristics of the teachers to the appropriate times for conducting programs and activities.

The conclusions, based on the findings in this chapter, have implications for inservice-education programs and activities for junior-high/middle-school science teachers in the Grand Rapids Public School...
System. These conclusions and implications, together with suggestions for programs and activities, based on these implications, are presented in the following chapter.
CHAPTER IV - DISCUSSION, CONCLUSIONS, SUGGESTIONS

Introduction

The purpose of this study was to (a) obtain information from a sample of junior-high/middle-school science teachers from the Grand Rapids Public School System and from a review of the literature, concerning selected parameters related to inservice-education programs, and (b) use that information to develop a strategy for developing and implementing such programs. By means of the two questionnaires described in Chapter II, certain elements of information were obtained from the sample of junior-high/middle-school science teachers. That information was organized into the following categories:

1. General characteristics of the teacher sample.
2. Inservice-education backgrounds of the teacher sample.
3. Perceived inservice-education needs of the teacher sample.

Based on a review of the literature, guidelines were elicited concerning selected parameters related to inservice-education programs. Also, from one of those questionnaires, perceptions were obtained from the sample of junior-high/middle-school science teachers, concerning those same parameters. The parameters that were selected include:

1. The purposes of inservice education.
2. The levels of organization of inservice programs and activities.
3. The formats of inservice programs and activities.
4. Topics for inservice programs.
5. The teacher's roles in inservice programs and activities.
6. People/organizations that influence inservice education.
7. The locations for inservice programs and activities.
8. The frequency for conducting inservice programs and activities.
9. The times when inservice programs and activities are scheduled.

The information that was obtained is summarized in Chapter III.

Factors

Prior to the narrative that follows, it seems appropriate to mention certain factors that have either been directly addressed earlier or are tacitly implied. The first of these factors involves the three assumptions that appear in Chapter II, page 33.

Assumptions

1. Junior-high/middle-school science teachers have unique inservice needs, experiences and perceptions that can be identified.

This assumption is defensible in that the data obtained from the questionnaires appear to be sufficient to draw conclusions concerning (a) the inservice needs of teachers in the sample, (b) the previous inservice experiences (inservice-education background) of teachers in the sample, and (c) the perceptions of teachers in the sample concerning the nine parameters, listed on page 72 and 73.

2. The instruments developed for this study are defensible for gaining the desired information.

For obtaining information from the teachers in the sample concerning their perceived inservice needs, the questionnaire entitled, Science Teacher Needs Assessment, was designed and distributed. This instrument was designed on the basis of the Moore Assessment Profile.
For obtaining information from the teachers in the sample concerning their (a) general characteristics, (b) inservice-education background, and (c) perceptions of certain parameters, the questionnaire entitled, Professional Development Survey, was designed and distributed. Items in this questionnaire were designed on the basis of items in three other questionnaires, described in Chapter II, page 27. Although this questionnaire was not validated, it was reviewed before distribution by this investigator's Doctoral Advisory Committee.

3. Junior-high/middle-school science teachers are professionals with sufficient interest in the profession to respond carefully to the questionnaires.

The extent to which this assumption may be valid must be judged in two ways. First, 81% of the teachers responded to all items on the Science Teacher Needs Assessment and 73% to all on the Professional Development Survey. Only one of each questionnaire had to be discarded because it was incomplete. Thus, more than 70% of the teachers showed sufficient interest to respond completely to each questionnaire. Second, it is difficult to judge how carefully teachers responded, because of certain discrepancies among the responses. A number of these will be discussed in the narrative that follows.

**Phenomena**

There are two other phenomena that seem worthy of mention, namely (a) "institutionalization" and (b) "internalization." Here institutionalization refers to the various planned inservice programs that are
implemented by the Grand Rapids Public School System and the extent to which they are considered to be a part of the total management of the education enterprise. This implies the commitment of finances to provide for released time for teachers for inservice programs offered within the school system and for attendance at conferences/conventions.

Internalization refers to the extent to which individual teachers in the sample accept the concept of inservice education and consider it to be an indispensable part of their professional growth. This implies the willingness of teachers to contribute "voluntary" time for inservice education in addition to the released time provided by the school system.

Some conclusions with respect to these two phenomena will appear in the narrative that follows.

Organization of the Narrative

Insofar as the research techniques used in this study for obtaining the desired information are defensible, the conclusions that emerge have implications for inservice-education programs for junior-high/middle-school science teachers in the Grand Rapids Public School System. In the narrative that follows, (a) findings from Chapter III will be discussed according to the categories and parameters listed on page 72 and 73, (b) conclusions will be drawn that have significance for each category and parameter, and (c) suggestions will be made concerning what should be included in inservice programs for junior-high/middle-school science teachers in the Grand Rapids Public School System.
General Characteristics of the Teacher Sample

Undergraduate Major and Minor

Discussion

According to the findings in Table 3, page 38 and 39, only 9% of the teachers in the sample have an undergraduate major in chemistry and only 2% have one in physics. Thus, 89% of teachers in the sample do not have an academic major in one, or both, of these areas of physical science. However, 60% reported having an academic major in either biology or earth science. The data also show that 63% of the teachers report a non-science academic minor. These findings indicate that over 50% of the teachers in the sample have science backgrounds that appear to be weakest in the physical sciences as well as being restricted to one field of science.

Conclusion

An examination of the performance objectives for junior-high/middle-school science teachers in the Grand Rapids Public School System, that appear in Appendix C, indicate that teachers are expected to cover topics in the three traditional areas of science, the physical, biological, and earth sciences. In order to cover those topics effectively, teachers should have subject-matter backgrounds that include the physical, biological, and earth sciences. Therefore, from these findings, it is reasonable to conclude that over 50% of the teachers in the sample have deficiencies in their subject-matter backgrounds, deficiencies especially in their physical-science backgrounds and in the breadth of
their science backgrounds.

**Suggestions**

Inservice-education programs for teachers in this sample should include subject-matter training that compensates for their deficiencies. These programs should include such training in the physical sciences, but not to the exclusion of some training in the earth and life sciences.

**Years of Teaching Experience**

**Discussion**

According to the findings in Table 3, page 38 and 39, (a) 11% of the teachers in the sample have 3 years or less of experience, (b) 29%, have 4 to 6 years, (c) 24%, have 7 to 9 years, and (d) 36%, have 10 years or more. However, 50% of those teachers have lengths of service that are 7 years or more.

**Conclusions**

Assuming that teachers' inservice needs are related to their length of service, it is reasonable to conclude that teachers in the sample have a wide range of these needs.

The inservice needs of the 50% with less than 7 years of experience may differ sufficiently from those of the 50% with 7 or more years of service to warrant using length of service as a criterion for developing alternative inservice programs.

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Suggestions

As part of an inservice strategy, the inservice needs of all the teachers should be identified and incorporated into inservice programs and activities. Since half the teachers had 7 years of experience or less, and half had 7 years or more, the inservice program might be organized on a dual track to accommodate both groups.

Grade Level of Teaching

Discussion

The findings in Table 3, page 38 and 39, indicate that 98% of the teachers reported their primary teaching assignment to be in grades 7, 8, and 9 whereas 42% of those teachers reported a preference for teaching in grades 10, 11, and 12.

Conclusions

It is reasonable to conclude from these findings that for over 40% of the teachers in the sample, a discrepancy exists between their present junior-high/middle-school teaching assignment (grades 7-9) and their preference for a high school assignment (grades 10-12).

Suggestions

As part of an inservice strategy, factors that contribute to this discrepancy should be identified. The inservice programs that are developed should be designed to address these factors and efforts should be undertaken to make teaching assignments at the junior-high/middle
school level more attractive.

Summary

Based on the conclusions and suggestions in this section, General Characteristics of the Teacher Sample, inservice-education programs should (a) include subject-matter training in all the sciences, especially in the physical sciences, (b) address the inservice needs of all teachers in the sample, with some accommodation for years of teaching experience, and (c) address the factors that contribute to the discrepancy between the existing assignment of teachers in the sample and their preference for teaching in high school.

Inservice-Education Background

Level of Education Completed

Discussion

The findings in Table 4, page 40 and 41, indicate that 57% of the teachers in the sample have at least a master's degree.

Conclusions

It may be recalled from the discussion, in Chapter I, on the history of inservice education of science teachers, that among other reasons, secondary-science teachers took graduate courses to accumulate credit for certification. This practice was common throughout that history, but especially during the period in which the NSF supported institutes. Thus, meeting certification requirements was an incentive
for science teachers to obtain inservice training. However, based on the certification standards for Michigan, more than 50% of the teachers in the sample have sufficient credits to maintain their certification. Therefore, it can be reasonably concluded that these teachers lack such an incentive to take graduate courses or other programs that offer graduate credit.

**Suggestions**

As part of an inservice strategy, incentives, other than accumulating credit for certification, should be identified and offered to teachers to stimulate their participation in these programs where such incentives would apply. This is not to suggest that teachers should always be provided with external incentives to stimulate their participation. On the contrary, teachers should also be stimulated by personal incentives such as need for professional growth.

**Science or Science Education Course Taken for Credit**

**Discussion**

The findings in Table 4, page 40 and 41, indicate that 54% of the teachers in the sample had not taken science and/or science-education courses during the four years prior to the study.

**Conclusions**

Based on the assumption that teachers, who had not taken science and/or science-education courses during the four years prior to the study, lack current training in such areas, it is reasonable to conclude
that over 50% of the teachers in the sample lack that training.

It may be noted that teachers who attended four successive NSF summer institutes were generally not eligible to participate for another four years. One may infer that the four-year interval was sufficient for considering the training of these teachers somewhat out-of-date.

Since, in order to teach science effectively in the junior-high/middle schools of the Grand Rapids Public School System, teachers should have current training in science and/or science education, one may conclude that this lack of training may reduce the quality of the learning experiences in the classroom.

Suggestions

Inservice programs should be designed to update teachers who lack current training in science and/or science education.

Most Recent Inservice Activity for Science Teaching

Discussion

The findings in Table 4, page 40 and 41, indicate that 63% of the teachers have not participated in an inservice activity for science teachers, other than the science and/or science-education courses referred to above, during the year prior to this study.

Conclusions

Since there were such inservice opportunities available to the junior-high/middle school science teachers, within the year prior to this study, it is reasonable to conclude that, for some reason or
another, over 60% of the teachers in the sample did not find these inservice opportunities attractive or there may have been barriers to their participation.

Suggestions

As part of an inservice strategy, the reasons should be identified and addressed as why 60% of the teachers were not involved in the inservice activities available to them.

Format of Activity

Discussion

According to the findings in Table 4, page 40 and 41, concerning their most recent inservice activity, (a) 67% of the teachers in the sample participated in a workshop, (b) 15% in a conference/convention, and (c) 9% in a continuing-education course. These findings indicate that workshops have been attended by over 60% of the sample, whereas, conferences/conventions have been attended by less than 20% and continuing-education courses by less than 10%.

Conclusions

These findings indicate discrepancies in the extent of participation in the different inservice activities that were available to the teachers in the sample.

Suggestions

As part of an inservice strategy, factors should be identified
that contribute to teachers preference for different formats of inservice programs. From these findings, inservice programs should be modified to increase the attractiveness of those that seem to be less attractive, if indeed they are determined to have value.

**Professional Growth Activities (Membership in Science Teachers Association, Professional Activities, Professional Journal Subscription)**

**Discussion**

The findings in Table 4, page 40 and 41, indicate that (a) 74% of the teachers in the sample were not affiliated with any professional association of science teachers, (b) 86% never participated in an NSF institute, (c) 94% never attended an NSTA convention, (d) 69% never participated in an MSTA convention, (e) 82% never served on a local curriculum committee, and (f) 71% do not subscribe to a journal for science teachers.

**Conclusions**

Based on the assumption that all the professional growth activities/opportunities, listed in this section of Table 4, page 40 and 41, are available, in one degree or another, to the junior-high/middle-school science teacher in the Grand Rapids Public School System, these findings suggest that more than 65% of these teachers have not participated in any of these activities/opportunities.

**Suggestions**

As part of an inservice strategy, factors that contribute to the
apparent lack of involvement by more than 65% of the teachers in these professional growth activities/opportunities, listed earlier, should be identified. Then, inservice programs should be designed that stimulate further participation.

Reason for Previous Participation

Discussion

Concerning their reasons for previous participation in inservice activities, the findings in Table 4, page 40 and 41, indicate that teachers in the sample rated as appropriate, "Professional growth." However, they rated as inappropriate (a) "Job promotion," (b) "Salary increase," and (c) "Administrative pressure."

Conclusions

The rating, given to "Professional growth" appears to be at variance with the earlier findings in Table 4, page 40 and 41, that indicate over 60% of the teachers in the sample claimed not to have been involved in such professional growth activities as (a) NSF Institutes, (b) NSTA Conventions, and (c) MSTA Conventions. Based on the concept that professional growth is an important motive for teachers in the sample to participate in inservice programs, it is reasonable to conclude that while these teachers claim to agree with this concept, over 60% of them have failed to act on it.

Suggestions

As part of an inservice strategy, an investigation should be made
to determine the factors that contribute to this disparity. It should be determined whether the teachers in the sample are paying lip service to the concept of professional growth or whether barriers exist that inhibit their participation in professional growth activities.

Description of Previous Inservice Experience

Discussion

Concerning their descriptions of previous inservice experiences, the findings in Table 4, page 40 and 41, indicate that teachers in the sample most frequently use words such as (a) "Educational," (b) "Worthwhile," (c) "Relevant," and (d) "Applicable," whereas they less frequently use words such as (a) "Timely," (b) "Wasteful," (c) "Not applicable," and (d) "Non-educational."

Conclusions

Findings in Table 4, page 40 and 41, described earlier, suggest that, in general, teachers in the sample have not been involved in inservice activities such as (a) continuing-education courses, and (b) conferences/conventions. Yet, commonly, they describe their experiences with positive terms such as (a) educational, (b) worthwhile, (c) relevant, and (d) applicable. The reasons for this disparity are unclear. However, the use of such positive terms for the experiences fails to justify the lack of involvement of the teachers.

Suggestions

As part of an inservice strategy, the reasons for the disparity,
described above, should be investigated. For, if indeed teachers perceptions are valid, then factors other than their perceptions of previous experience must contribute to their lack of involvement. Those factors should be identified and addressed in inservice activities.

**Summary**

The findings in this section, **Inservice-Education Background**, suggest that teachers have minimal involvement in inservice experiences such as (a) continuing education courses, especially science and science education courses, (b) conferences/conventions such as those sponsored by NSTA and MSTA, (c) curriculum committees, (d) NSF Institutes, and (e) professional associations and their journals.

These findings need to be considered in view of the phenomena of "institutionalization" and "internalization" (see page 74 and 75). It may be assumed that the Grand Rapids Public School System has not dedicated itself to institutionalizing inservice programs for junior-high/middle-school science teachers. Also, it may be assumed that teachers in the sample have not internalized the importance of inservice education for their professional growth. These conclusions became increasingly apparent as the findings in Table 4, page 40 and 41, were examined. The problems involved are of sufficient magnitude to warrant the establishment of a high-level advisory council to investigate the factors that may be responsible and the solutions that may be available.

**Perceived Inservice-Education Needs**

**Needs of Critical Importance**
Discussion

Of the 46 needs, identified in the Science Teacher Needs Assessment, six, listed in Table 5, page 43, emerged as those that teachers in the sample perceived to be of critical importance. Those needs are (a) "Sharing science teaching ideas with other science teachers," (b) "Designing laboratory activities for more effective science instruction," (c) "Designing demonstrations for more effective science instruction," (d) "Adapting the science curriculum to the appropriate achievement levels of the students," (e) "Organizing science curriculum materials for more effective instruction," and (f) "Effectively evaluating and testing students' attainment of the course objectives."

Conclusions

The fact that the need, "Sharing science teaching ideas . . ." was rated in this group seems to be related to earlier findings from Table 4, page 40 and 41, that indicated minimal involvement by teachers in such inservice activities as (a) continuing-education courses and (b) conferences/conventions where such sharing could take place. Concerning the other five needs in Table 5, page 43, it appears that teachers perceive their needs to be in instructional techniques such as (a) designing laboratory and demonstration activities, (b) adapting and organizing curriculum materials, and (c) evaluating and testing students on course objectives. The ratings of such needs may be related to findings in Table 4, page 40 and 41, that indicate that 54% of the teachers were not recently involved in a science education and/or science course, where such topics should be covered.
On the basis of these comparisons between perceived inservice needs and actual needs, it can be reasonably concluded that those needs listed in Table 5, page 43, represent inservice needs appropriate for teachers in the sample.

Suggestions

The needs, identified in this section, should be the primary basis for the objectives for inservice-education programs and activities for teachers in the sample.

Needs of Moderate Importance

Discussion

The findings in Table 6, pages 44-46, list 38 inservice needs that teachers perceived to be of moderate importance.

Conclusions

Those needs, related to updating in subject-matter, such as (a) "Updating in Chemistry," (b) "Updating in Physics," and (c) "Updating in Earth Science" were perceived to be of moderate importance. Only when inservice needs, emerging from the Science Teacher Needs Assessment, were ranked in another way (see Table 8, p. 48) did one such need, "Updating in present knowledge in Physics," emerge as critical. However, the ranking of these needs as moderate seems to suggest that teachers in the sample did not recognize an inservice need, suggested earlier in this chapter, concerning updating their science subject-matter backgrounds. Therefore, inservice needs perceived to be of
moderate importance by teachers may, in fact, be of critical importance.

Suggestions

Not only should the needs be addressed that teachers in the sample perceived to be of critical importance in inservice-education programs, but also those that they perceived to be of moderate importance but are, in fact, critical. Since the teachers in the sample have both kinds of needs, inservice-education programs should be designed to address both.

Needs of Slight Importance

Discussion

The findings in Table 7, page 47, indicate two inservice needs that teachers in the sample perceived to be of slight importance, namely (a) "Guidance and assistance in science teaching from the local university or college," and (b) "Guidance and assistance in science teaching from the science supervisor." These findings suggest that the teachers in the sample do not perceive a need for help with their teaching from these outside sources.

Conclusions

These findings seem inconsistent with the nature and extent of the needs listed in Table 5, page 43, that teachers in the sample perceived to be of critical importance. It would be difficult to address effectively five of those needs, related to science-teaching methodologies without guidance and assistance from the science supervisor and/or
college personnel. These needs are in the areas of (a) designing laboratory activities and demonstrations, (b) adapting and organizing curriculum materials, and (c) evaluating the attainment of course objectives. The findings in Table 7, page 47, suggest that the need for this guidance and assistance, perceived to be of slight importance may, in fact, be of critical importance.

Suggestions

If the critical inservice needs of teachers in the sample are to be addressed effectively, then the science supervisor and/or college personnel need to be involved. However, in addressing those needs, the roles of such sources should be to assist, not dominate.

Summary

It is evident from the findings in this section entitled, Perceived Inservice-Education Needs, that teachers in the sample have needs that are critical. Those needs, described in this section, should be incorporated into inservice programs and activities for junior-high/middle-school science teachers in the Grand Rapids Public School System.

Parameters

In order to institutionalize inservice programs for junior-high/middle-school science teachers in the Grand Rapids Public School System, it seemed necessary to investigate the parameters relevant to such programs. This investigation was accomplished by reviewing the literature in order to identify and describe these parameters and by having
teachers in the sample rate their perceptions of them. Nine parameters were identified using these techniques. The findings from the review and the ratings were then analyzed and internal comparisons were made among them. These findings were also compared with those that appear earlier in this chapter.

From the conclusions that emerged from the findings, specific suggestions are made for implementing inservice-education programs for the sample of teachers in the Grand Rapids Public School System.

**Purposes of Inservice Education**

**Discussion**

According to the guidelines that were elicited from the literature review and that appear on page 52 and 53, the purposes of inservice education should (a) be based on the needs of teachers, (b) be consistent with school goals and plans, (c) be specified clearly, (d) stress teaching outcomes, (e) include the development of curriculum, and (f) include the improvement of instruction.

The perceptions of the teachers in the sample of certain purposes of inservice education were determined by their responses to four items on the Professional Development Survey. The findings in Table 9, page 54, indicate that the teachers in the sample rated all four purposes as being appropriate. These purposes are (a) "Sharing teaching methods," (b) "Updating in content," (c) "Implementing curriculum," and (d) "Choosing curriculum."
Conclusions

These findings are consistent with the guidelines, elicited from the literature and also with the critical inservice needs, referred to in the previous section. However, these findings are inconsistent with the findings from Table 4, page 40 and 41, for, despite the fact that teachers rated "updating in content" to be an appropriate purpose for inservice-education, over half of them appeared to be involved minimally in inservice-education activities that provided such updating.

Suggestions

The purposes for inservice education, elicited from both the literature review and the teachers' perceptions, are consistent with perceived and actual inservice needs of the teachers in the sample. It is for those purposes that inservice programs must be planned and implemented.

Levels of Organization for Inservice-Education Programs and Activities

Discussion

According to the guidelines elicited from the literature review and listed on page 54, inservice activities should be organized (a) locally, and (b) for teachers who teach specific subjects at specific grade levels.

Concerning their perceptions of certain levels of organization for inservice programs, the findings in Table 10, page 55, indicate that teachers in the sample rate as appropriate (a) "Building/Department,"
(b) "Individualized," and (c) "Systemwide," and as inappropriate (a)
"Countywide," (b) "Statewide," and (c) "Nationwide."

Conclusions

Those levels rated as appropriate by the sample of the teachers are supported by the findings from the literature. The inappropriate rating given the levels, "Statewide" and "Nationwide," support earlier findings, from Table 5, page 43, that showed teachers in the sample were involved minimally in inservice programs on such levels. Despite the apparent emphasis that the literature and the teachers in the sample place on inservice programs organized on the individual, building, and systemwide levels, it is apparent that over half of the teachers have been minimally involved in such programs.

Suggestions

It is reasonable to suggest that the minimal involvement on the part of teachers in the sample is due, in part, to minimal efforts on the part of those primarily responsible for organizing programs on the levels, described above. Therefore, if inservice programs are to be organized successfully, on these levels, the people with primary responsibilities for instructional improvement should be involved.

Formats for Inservice-Education Programs and Activities

Discussion

According to the guidelines elicited from the literature review and listed on page 56, inservice-education programs should include

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formats such as (a) workshops, (b) demonstrations, (c) visitations, (d) seminars, (e) individual study, and (f) conferences/conventions.

Concerning their perceptions of certain formats for inservice education programs, the findings in Table 11, page 58, indicate that teachers in the sample rated all the formats listed there, to be appropriate, except the one entitled, "Newsletters and other publications."

Conclusions

These findings seem to be consistent with those elicited from the literature. Also, the high rating given by the teachers to the "workshop" format seems to be consistent with an earlier finding in Table 4, page 40 and 41, that indicated 69% of teachers in the sample had been involved in such activities. In addition, the high ratings given by the teachers in the sample to the "demonstration" and "workshop" formats seem to be related to their needs reported in Table 5, page 43, to share teaching ideas with other teachers. However, the appropriate rating given to "college courses" and "conferences/conventions" is inconsistent with findings in Table 4, page 40 and 41, reported earlier, where such teacher involvement was indicated as being minimal.

Suggestions

Inservice-education programs should be offered in a variety of formats consistent with the literature and the teachers perceptions. However, an emphasis should be placed on those formats, such as workshops and demonstrations, that encourage the mutual sharing of methodologies by the teachers in the sample.
Topics for Inservice-Education Programs and Activities

Discussion

According to the guidelines, elicited from the literature review and listed on pages 57-59, topics for inservice-education programs should (a) be generated by teacher needs, (b) be practical rather than theoretical, (c) include new teaching practices, (d) include new programs, and (e) include new knowledge.

Concerning their perceptions of certain topics for inservice-education programs, the findings in Table 12, page 60, indicate that teachers in the sample rate as appropriate, all topics listed. Those topics are (a) "Updating in science content," (b) "Recent discoveries in science," (c) "Science teaching methods," (d) "Science curriculum development," and (e) "Testing/evaluating objectives."

Conclusions

These findings seem to be consistent with those from the literature, and also with findings from Table 9, page 54, reported earlier, concerning purposes of inservice education. In both tables, the teachers rated curriculum development items to be appropriate purposes as well as appropriate topics. Those items are (a) developing curriculum, (b) implementing curriculum, and (c) choosing curriculum. The high rating given the topic "updating in science content" seems inconsistent with earlier findings in Table 6, pages 44-46, where teachers rated this as a need of only moderate importance. However, since earlier findings from Table 3, page 38 and 39, suggested that teachers in the
sample need to be updated in subject-matter, the topic seems indeed appropriate.

Suggestions

Inservice-education programs should include a variety of topics. This concept is confirmed by guidelines, elicited from the literature as well as from perceptions of the teachers. Topics should be consistent with the perceived and actual needs of these teachers.

Teacher's Roles in Inservice-Education Programs

Discussion

According to the guidelines, elicited from the literature review and listed on page 60 and 61, the roles of teachers in inservice-education programs include (a) developing and planning inservice programs, (b) choosing goals and activities, and (c) constructing curriculum materials. Concerning their perceptions of their roles in inservice-education programs, the findings in Table 13, page 62, indicate that teachers rate the following as appropriate roles: (a) "Active participants," (b) "Evaluator," and (c) "Planner/Organizer," and rate "Presenter" as inappropriate.

Conclusions

These findings seem to be consistent with those from the literature. However, the rating of "Active participant" seems to be inconsistent with earlier findings from Table 4, page 40 and 41, indicating that teachers in the sample had little involvement with any of the activities
listed therein.

Suggestions

Based on the guidelines, elicited from the literature and the perceptions of teachers, teachers should be active in at least three phases of the inservice strategy. Those phases are (a) planning/organizing activities, (b) participating in activities, and (c) evaluating activities.

People/Organizations that Influence Inservice Education

Discussion

According to the guidelines, elicited from the literature review and listed on page 62 and 63, the following people/organizations should have an influence on inservice education for science teachers: (a) science coordinators and consultants, (b) state science supervisors, (c) science educators, and (d) area colleges/universities.

Concerning their perceptions of people/organizations that should influence inservice-education, the findings in Table 14, page 64, indicate that teachers in the sample rate as appropriate the (a) "Science supervisor", and (b) "Science department head." On the other hand, they rated as inappropriate the (a) "Professional Science Teacher Associations (i.e. NSTA)," (b) "University science educators," (c) "State Department of Education," (d) "Building Administration," and (e) "Local bargaining association (i.e. GRE A)." A comparison of these findings with those in Table 15, page 65, in which teachers in the sample were asked to rate people/organizations that do influence inservice-education,

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indicate similar responses except that teachers perceived only the science supervisor as having any actual influence on inservice education.

Conclusions

These findings seem to be inconsistent with those of the literature, especially those concerning the influence of university science educators and state department personnel. Despite what the literature seems to suggest, the teachers in the sample perceive these people as having minimal influence in inservice education. Such minimal influence of the science educator on inservice programs of teachers in the sample seems to be consistent with findings from Table 4, page 40 and 41, that indicate a minimal involvement by teachers in science and science-education courses. On the other hand, the rating of the science supervisor as one who can and does influence inservice education seems to be inconsistent with earlier findings from Table 7, page 47, that indicated that teachers in the sample had little need for guidance and assistance from a science supervisor.

Suggestions

Since there is a disparity between what appears in the literature concerning the people/organizations that should influence inservice education of science teachers and those perceived by the teachers in the sample, efforts should be undertaken to determine why such a disparity exists and, if appropriate, take measures to change teacher perceptions.

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Location for Conducting Inservice-Education Programs

Discussion

According to the guidelines, elicited from the literature review and listed on page 64 and 65, the buildings of the school system are more appropriate sites for inservice-education programs than are college sites.

Concerning their perceptions of certain locations for conducting inservice-education, the findings in Table 16, page 66, indicate teachers perceived as appropriate both the "Local school" and the "Local college/university" and as inappropriate, "A non-education setting."

Conclusions

The appropriate rating given the local school appears to be consistent with findings from Table 10, page 55, where teachers rated the building/department as an appropriate level of organization for inservice programs. The appropriate rating given the local college/university does not seem to be consistent with the guidelines from the literature review nor consistent with earlier findings from Table 4, page 40 and 41. As indicated in the literature, the college site is considered to be less appropriate for inservice programs than the school site. Teachers, however, indicated that both sites were appropriate. This rating seems to be inconsistent with earlier findings from Table 4, page 40 and 41, that indicated a minimal involvement by the teachers in the sample in college/university-type inservice activities. This is also inconsistent with earlier findings from Table 7, page 47, that
indicated that teachers claimed they needed little guidance and assistance from personnel in colleges/universities.

Suggestions

The findings from the literature and the teachers suggest that the local school is an appropriate location for conducting inservice programs. Because of the escalating expense for transportation, as well as the limited time of the teacher, it is reasonable to conclude that, whenever possible, inservice programs should be conducted at one of the buildings in the school system.

Frequency in Conducting Inservice-Education Programs

Discussion

According to the guidelines, elicited from the literature review, and listed on page 67, inservice-education programs should be conducted on a continuous basis. However, a review of the literature concerning this parameter failed to indicate what the frequency should be.

Concerning their perceptions of certain frequencies in conducting inservice-education programs, the findings in Table 17, page 68, indicate that teachers in the sample rated only "Once a semester" to be appropriate, whereas they rated as inappropriate (a) "Once a year," (b) "Monthly," (c) "A week or two in the summer," and (d) "Weekly."

Conclusions

This finding is inconsistent with that in the literature suggesting that inservice programs be offered "continuously." Obviously, it
is apparent that "once a semester" is less frequent than "continuously." This rating given to "Once a semester" appears to be consistent with earlier findings in Table 4, page 40 and 41, that indicate infrequent participation on the part of teachers in the sample. Despite the appropriateness given "Once a semester," it is indicated in Table 4, page 40 and 41, that 63% of the teachers in the sample participated even less than once a semester.

Suggestions

Based on the time it would take to address the inservice needs, topics, and purposes, discussed in this chapter, once a semester is too infrequent for conducting inservice programs. However, (a) considering the lack of effort on the part of the school system to designate the appropriate frequency for inservice programs, and (b) considering that the teachers in the sample have exerted minimal effort to get involved in inservice programs, more frequent inservice programs may be difficult to implement.

Time When Inservice-Education Programs are Scheduled

Discussion

According to the guidelines, elicited from the literature review, and listed on page 69, released time during the school day appears to be the most appropriate for scheduling inservice-education programs.

Concerning their perceptions of certain times for participating in inservice-education programs, the findings in Table 18, page 70, indicate that teachers in the sample rated as appropriate, "During
school (released time)' and as inappropriate (a) "Immediately after school," (b) "Summers," (c) "Evenings," (d) "Before school," and (e) "Weekends."

Conclusions

These findings are consistent with those from the literature concerning the appropriateness of released time, and consistent with earlier findings from Table 4, page 40 and 41, that indicate minimal involvement by teachers in the sample in inservice activities held outside school hours.

Suggestions

The findings from the literature review and the teachers' perceptions suggest the need for more released time during school hours for inservice education. As increasing demands are placed on the teachers' time, the time for voluntary inservice training is reduced. It is reasonable to suggest that additional released time should be made available for inservice training. However, the nature and extent of the inservice needs, presented in this chapter, suggests a variety of activities some of which would have to be scheduled after school, evenings or summers.

Summary

Based on the findings listed in this section, Parameters of In-service Education, the following recommendations were made concerning implementing inservice programs for junior-high/middle-school science
1. The purposes of inservice education should be based on needs of the teachers in the sample.

2. The levels of organization in which inservice programs are offered should emphasize activities that are (a) individualized, (b) building/department, and (c) systemwide.

3. The formats for inservice programs should primarily include (a) workshops, (b) demonstrations, (c) visitations, (d) seminars, and (e) continuing education courses.

4. The topics of inservice programs should coincide with inservice needs and purposes.

5. The teacher's roles in inservice education should include (a) planning/organizing inservice programs and activities, (b) participating in activities, and (c) evaluating those activities.

6. The people/organizations that influence inservice programs should include (a) the science supervisor in the school system, (b) the science department head, and (c) the local science educator.

7. The location for holding inservice programs should be one of the school buildings.

8. The frequency for conducting inservice programs should be a matter of negotiation between the teachers and the school system. However, once a semester does not seem to be sufficient to accomplish what needs to be done.

9. The times when inservice programs are scheduled should primarily be released time, during the school day, but the issue of "voluntary time" during other periods should be a subject of negotiation.
Conclusion

Based on the findings of the study, several suggestions emerged for designing and implementing inservice programs for the junior-high/middle-school science teachers in the Grand Rapids Public School System. These suggestions, described earlier in this chapter, are the essence of the inservice education strategy for which this study was undertaken. These suggestions, although they are made for a specific sample of teachers, probably have application to similar educational settings.

The success of this strategy must be judged on the degree to which the suggestions are implemented. This implementation is limited by two variables, described earlier in this chapter.

Institutionalization

The success of this strategy depends on a commitment on the part of a school system to inservice education. This commitment is ultimately based on the extent to which financial resources are made available to implement various inservice programs.

Internalization

The success of this strategy depends, also, on a commitment on the part of teachers to professional growth. This commitment is ultimately based on the extent to which teachers are willing to participate in various inservice activities that are suggested by this study.

Recommendations for Further Research

In the course of developing a strategy of inservice education,
new questions emerged that deserve further investigation and research. These questions are:

1. What effect does the local bargaining association (GREA) have on the involvement in inservice programs by junior-high/middle-school science teachers?

2. What factors affect the institutionalization of inservice education in the Grand Rapids Public School System?

3. How do the perceived inservice-education needs of junior-high/middle-school science teachers in a school system, such as Grand Rapids, compare with those of teachers in (a) other geographical areas, (b) smaller and larger school systems, (c) rural-school systems, and (d) parochial-school systems?

4. What factors affect the internalization of the concept of professional growth by junior-high/middle-school science teachers in the Grand Rapids Public School System?
Science Teacher Needs Assessment

The purpose of this questionnaire is to identify the in-service needs of science teachers with respect to:

1. The development of a better understanding of students.
2. The betterment of diagnosis and evaluation practices.
3. The development of better classroom management practices.
4. The improvement of classroom instruction and planning.
5. The more effective use of instructional materials.
6. The self-improvement of the classroom science teacher.

Your cooperation will be deeply appreciated.

David A. DeGraaf

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<td>6. More than 12 years</td>
</tr>
</tbody>
</table>

MATH/SCIENCE DEPARTMENT 456-4960
<table>
<thead>
<tr>
<th></th>
<th>Need Assessment</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>Organizing science curriculum materials for more effective instruction.</td>
<td>Moderate Need</td>
<td>Moderate Need</td>
<td>Moderate Need</td>
<td>Moderate Need</td>
</tr>
<tr>
<td>14.</td>
<td>Adapting the science curriculum to the appropriate achievement levels of the students.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>15.</td>
<td>Adapting the science curriculum to individual needs.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>16.</td>
<td>Designing lab activities for more effective science instruction.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>17.</td>
<td>Designing demonstrations for more effective science instruction.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>18.</td>
<td>Obtaining information on how the course objectives relate to science education in the elementary and senior high school.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>19.</td>
<td>Overcoming difficulties encountered in providing field trips outside the classroom (locating suitable places, transportation, approval, funds, etc.).</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>20.</td>
<td>Obtaining supplementary science books for students on appropriate grade levels.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>21.</td>
<td>Effectively utilizing the textbooks, Focus on Science, teacher's manual, supplementary materials, etc.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>22.</td>
<td>Utilizing the library and its facilities to supplement science instruction.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>23.</td>
<td>Obtaining and utilizing audio-visual materials as instructional media.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>24.</td>
<td>Obtaining and utilizing community resources (speakers, field trips, etc.).</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>25.</td>
<td>Preparing instructional materials for general classroom use.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>26.</td>
<td>Preparing instructional materials for enrichment.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>27.</td>
<td>Finding places for field trips where natural physical principles can be illustrated (quarries, weather stations, etc.).</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>28.</td>
<td>Finding places for field trips where applied physical principles can be illustrated (airports, factories, etc.).</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>29.</td>
<td>Updating of present knowledge of content in Biology.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>30.</td>
<td>Updating of present knowledge of content in Earth Science.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>31.</td>
<td>Updating of present knowledge of content in Chemistry.</td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
</tbody>
</table>
### Science Teacher Needs Assessment

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>No Need</td>
<td>Little Need</td>
<td>Moderate Need</td>
<td>Much Need</td>
</tr>
<tr>
<td>32.</td>
<td>Updating of present knowledge in Physics.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>33.</td>
<td>Updating of present knowledge in Mathematics.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>34.</td>
<td>Effectively integrating the Focus on Science modules with the course objectives.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>35.</td>
<td>Effectively using the &quot;activities&quot; in the modules to teach the course objectives.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>36.</td>
<td>Meeting the objectives in the unit: &quot;How Scientists Work.&quot;</td>
<td></td>
<td></td>
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<tr>
<td>37.</td>
<td>Meeting the objectives in the unit: &quot;Atmosphere.&quot;</td>
<td></td>
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<tr>
<td>38.</td>
<td>Meeting the objectives in the unit: &quot;Ecology and Conservation.&quot;</td>
<td></td>
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<tr>
<td>39.</td>
<td>Meeting the objectives in the unit: &quot;Astronomy.&quot;</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>40.</td>
<td>Meeting the objectives in the unit: &quot;Life Science.&quot;</td>
<td></td>
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<tr>
<td>41.</td>
<td>Meeting the objectives in the unit: &quot;Health.&quot;</td>
<td></td>
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<tr>
<td>42.</td>
<td>Meeting the objectives in the unit: &quot;Matter and Change.&quot;</td>
<td></td>
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<tr>
<td>43.</td>
<td>Meeting the objectives in the unit: &quot;Physics.&quot;</td>
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<tr>
<td>44.</td>
<td>Meeting the objectives in the unit: &quot;Energy.&quot;</td>
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<tr>
<td>45.</td>
<td>Meeting the objectives in the unit: &quot;Human Body.&quot;</td>
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<tr>
<td>46.</td>
<td>Meeting the objectives in the unit: &quot;Changing Earth.&quot;</td>
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<tr>
<td>47.</td>
<td>Other needs relative to your science teaching (Please specify).</td>
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</tbody>
</table>

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Investigations into the in-service needs of science teachers show a number of areas in which they need and desire help. Below is a list of some of these needs.

Indicate the degree of intensity of need for you by placing a check (√) in:

Column 1 if you feel no help is needed or the need is not applicable.
Column 2 if you feel little help is needed.
Column 3 if you feel moderate help is needed.
Column 4 if you feel much help is needed.

<table>
<thead>
<tr>
<th>Science Teacher Needs Assessment</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Obtaining information on your students' prior achievement in science.</td>
<td></td>
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</tr>
<tr>
<td>2. Obtaining information on your students' attitudes, needs, and interests in science.</td>
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<tr>
<td>3. Effectively evaluating and testing students' attainment of the course objectives.</td>
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</tr>
<tr>
<td>4. Effectively evaluating your students' knowledge of science in general.</td>
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<tr>
<td>5. Establishing and maintaining adequate safety conditions in the classroom.</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6. Establishing and maintaining adequate safety conditions in the laboratory.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Establishing and maintaining adequate safety conditions on field trips.</td>
<td></td>
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<tr>
<td>8. Developing daily lesson plans.</td>
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<tr>
<td>9. Developing long range units of work.</td>
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</tr>
<tr>
<td>10. Guidance and assistance in science teaching from the science supervisor.</td>
<td></td>
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</tr>
<tr>
<td>11. Guidance and assistance in science teaching from the local university or college.</td>
<td></td>
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</tr>
<tr>
<td>12. Sharing science teaching ideas with other science teachers.</td>
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</tbody>
</table>

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**SCIENCE TEACHER PROFESSIONAL DEVELOPMENT SURVEY**

Please respond to all items on this questionnaire. It has been designed as a checklist that can be completed in about 10 minutes. Thank you for your cooperation.

### A. GENERAL INFORMATION

1. What was your undergraduate academic major?
   - a) Biology
   - b) Chemistry
   - c) Physics
   - d) Earth Science
   - e) Other (please specify)

2. What was your undergraduate academic minor?
   - a) Biology
   - b) Chemistry
   - c) Physics
   - d) Earth Science
   - e) Other (please specify)

3. At what levels does your teaching certificate allow you to teach?
   - a) K-12
   - b) K-8
   - c) K-6
   - d) 7-12

4. How many years have you been teaching?
   - a) Less than 1
   - b) 1-3
   - c) 4-6
   - d) 7-9
   - e) 10-12
   - f) More than 12

5. What courses, if any, do you teach besides science?
   - a) Mathematics
   - b) English
   - c) Social Studies
   - d) Physical Ed
   - e) Other (please specify)

6. At what grade level do you teach most of your classes?
   - a) 7
   - b) 8
   - c) 9
   - d) 10-12

---

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7. At what level do you prefer to teach?
   a) 7 ........
   b) 8 ........
   c) 9 ........
   d) 10-12 ........

B. INSERVICE EDUCATION EXPERIENCE

1. What is the highest level of education you have completed?
   a) Bachelor's ........
   b) Bachelor's plus ........
   c) Master's ........
   d) Master's plus ........
   e) Other (please specify)

2. How recently have you taken a science or science education course for academic credit?
   a) Less than 1 year ago ........
   b) 1-3 years ago ........
   c) 4-6 years ago ........
   d) More than 6 years ago ........

3a. How recently have you participated in an inservice activity that was related specifically to science teaching?
   a) Less than 1 year ago ........
   b) 1-3 years ago ........
   c) 4-6 years ago ........
   d) More than 6 years ago ........
   e) Never ........

3b. What was the format of the inservice activity referred to in 3a?
   a) Continuing education course ........
   b) Workshop ........
   c) Conference/convention ........
   d) Other ........

4. To which, if any, of these science teacher associations do you belong?
   a) National Science Teachers Association (NSTA) ........
   b) Michigan Science Teachers Association (MSTA) ........
   c) Michigan Environmental Education Association (MEEA) ........
   d) Other (please specify) ........
   e) None ........
5. In which, if any, of the following professional activities have you participated?
   a) National Science Foundation Institute
   b) National Science Teachers Association Convention
   c) Michigan Science Teachers Association Convention
   d) A local science curriculum committee
   e) None

6. Do you subscribe to journals or periodicals that are related specifically to science teaching?
   a) Yes    No
   b) If 6a is "Yes", please specify

7. If you have participated in science teacher inservice activities, how would you rate these reasons for your participation?

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Very Important</th>
<th>Important</th>
<th>Unimportant</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Professional growth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Salary increase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Job promotion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Administrative pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Check the terms that best describe your previous inservice experiences.
   a) Relevant    Irrelevant
   b) Educational  Noneducational
   c) Worthwhile   Wasteful
   d) Applicable   Not applicable
   e) Timely      Not timely
   f) Other (please specify)
C. PERCEPTIONS OF INSERVICE EDUCATION

1. How would you rate the appropriateness of these levels of organization at which inservice education for science teachers should be conducted?

<table>
<thead>
<tr>
<th>Levels</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Individualized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Building/Department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) System wide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) County wide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Statewide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Nationwide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. How would you rate the appropriateness of these times for participating in inservice activities?

<table>
<thead>
<tr>
<th>Times</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Before school</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) During school (released time)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Immediately after school</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Evenings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Weekends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Summers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. How would you rate the appropriateness of the frequencies for your participation in inservice activities for science teachers?

<table>
<thead>
<tr>
<th>Frequencies</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Weekly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Monthly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Once a semester</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>d) Once a year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) A week or two in the summer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. How would you rate the appropriateness of these formats for inservice activities for science teachers?

<table>
<thead>
<tr>
<th>Formats</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) College/University courses for credit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Demonstration lessons by other science teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Workshops with high participant involvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Seminars offered by knowledgeable people</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Visits to other programs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Time to attend conferences and/or conventions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Sabbatical leave of absence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Newsletters and other publications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. How would you rate the appropriateness of these locations for holding inservice meetings?

<table>
<thead>
<tr>
<th>Locations</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Local school</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Local college/university</td>
<td></td>
<td></td>
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<tr>
<td>c) A noneducational setting</td>
<td></td>
<td></td>
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<tr>
<td>d) Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. How would you rate the appropriateness of these topics for inservice?

<table>
<thead>
<tr>
<th>Topics</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Science curriculum development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Science teaching methods</td>
<td></td>
<td></td>
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<tr>
<td>c) Updating in science content</td>
<td></td>
<td></td>
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<tr>
<td>d) Recent discoveries in science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Testing/Evaluating objectives</td>
<td></td>
<td></td>
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<tr>
<td>f) Other</td>
<td></td>
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</tbody>
</table>

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7. How would you rate the appropriateness of these roles for the science teacher in inservice activities?

<table>
<thead>
<tr>
<th>Roles</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Active participant</td>
<td></td>
<td></td>
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<tr>
<td>b) Planner/Organizer</td>
<td></td>
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<td>c) Presentor</td>
<td></td>
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<tr>
<td>d) Evaluator</td>
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<tr>
<td>e) Other</td>
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</tbody>
</table>

8. How would you rate the degree of influence these people or organizations should have on science teacher inservice?

<table>
<thead>
<tr>
<th>People/Organizations</th>
<th>Great</th>
<th>Moderate</th>
<th>Little</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) University science educators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Professional science teacher associations (i.e. NSTA)</td>
<td></td>
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<tr>
<td>c) Science supervisor</td>
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<tr>
<td>d) Science department head</td>
<td></td>
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<tr>
<td>e) Building administration</td>
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<tr>
<td>f) Local bargaining association (i.e. GREA)</td>
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<tr>
<td>g) State Department of Education</td>
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<td></td>
</tr>
<tr>
<td>h) Other</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

9. How would you rate the degree of influence these people or organizations do have on science teacher inservice?

<table>
<thead>
<tr>
<th>People/Organizations</th>
<th>Great</th>
<th>Moderate</th>
<th>Little</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) University science educators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Professional science teacher associations (i.e. NSTA)</td>
<td></td>
<td></td>
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<tr>
<td>c) Science supervisor</td>
<td></td>
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<tr>
<td>d) Science department head</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>e) Building administration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Local bargaining association</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) State Department of Education</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
10. How would you rate the degree of influence these factors have on your willingness to participate in an inservice activity?

<table>
<thead>
<tr>
<th>Factors</th>
<th>Great</th>
<th>Moderate</th>
<th>Little</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Location</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>b) Time</td>
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<td></td>
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<tr>
<td>c) Topic</td>
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<td></td>
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<tr>
<td>d) Presenter</td>
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<tr>
<td>e) Format</td>
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<tr>
<td>f) Previous experience</td>
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<tr>
<td>g) Financial incentives</td>
<td></td>
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<tr>
<td>h) Administrative encouragement</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>i) Peer pressure</td>
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<td></td>
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</tr>
<tr>
<td>j) Other</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

11. How would you rate the appropriateness of these purposes for science teacher inservice education?

<table>
<thead>
<tr>
<th>Purposes</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Updating in content</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Sharing teaching methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Choosing curriculum</td>
<td></td>
<td></td>
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<tr>
<td>d) Implementing curriculum</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>e) Other</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

12. How would you rate the appropriateness of these items to be included in a teachers' contract?

<table>
<thead>
<tr>
<th>Items</th>
<th>Very Appropriate</th>
<th>Appropriate</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Extending the school year for inservice activities</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>b) Extending the school day for inservice activities</td>
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<tr>
<td>c) Additional released time for inservice activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Additional reimbursement for inservice expenses</td>
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</tbody>
</table>
13. Please feel free to make any comments you choose in the space provided below.
Appendix B

Communications
I am looking forward to meeting with you on Monday, Oct. 29 at 3:30 PM in the "Lucy" meeting room (5th floor of JC's north building).

At this meeting I hope that we can identify and validate needs of Middle School/Junior High Science Teachers. Attached is a list of science teacher needs that I compiled from several sources. Please read this list over carefully and be prepared to make clarifications, additions and deletions. Also, please bring this list with you to the meeting.

Sincerely,

David Degraaf
Grand Rapids Public Schools
Grand Rapids, Michigan

Science Teacher Needs List

I. NEEDS RELATED TO THE DEVELOPMENT OF A BETTER UNDERSTANDING OF STUDENTS
1. Motivating students to learn through a greater knowledge of their needs in science.
2. Motivating students to learn through a greater knowledge of their interests in science.
3. Motivating students to learn through a greater knowledge of their attitude toward science.
4. Other needs relative to the development of a better understanding of students.

II. NEEDS RELATED TO THE BETTERMENT OF DIAGNOSIS AND EVALUATION PRACTICES
1. Evaluating pupil science progress by evaluation of individual pupils.
2. Evaluating pupil science progress by evaluation of group activities.
3. Effectively reporting pupil science progress to students.
4. Effectively evaluating course objectives.
5. Other needs relative to the betterment of diagnosis and evaluation practices.

III. NEEDS RELATED TO THE DEVELOPMENT OF BETTER CLASSROOM MANAGEMENT PRACTICES
1. Organizing classroom materials (desks, tables, bulletin boards, etc.) so that maximum science learning results.
2. Grouping of students within a classroom for the purpose of giving students realistic science experiences.
3. Establishing and maintaining discipline in the classroom.
4. Establishing and maintaining discipline in the laboratory.
5. Maintaining adequate safety conditions in the classroom.
6. Maintaining adequate safety conditions in the laboratory.
7. Maintaining adequate safety conditions on excursions and field trips.
8. Other needs relative to the development of better classroom management practices.

IV. NEEDS RELATED TO THE IMPROVEMENT OF CLASSROOM INSTRUCTION AND PLANNING
1. Writing objectives in terms of performance.
2. Developing daily lesson plans.
3. Developing long range units of work.
4. Guidance and assistance in science instruction from the science supervisor.
5. Guidance and assistance in science instruction from other science teachers.
6. Guidance and assistance in science instruction from the local university or college.
7. Organizing science resources and materials for more effective instruction.
8. Presenting science on appropriate grade level of students.
9. Making science meaningful to students.
10. Demonstrating principles by performing simple experiments.
11. Teaching the scientific processes to students (observing, inferring, graphing, drawing conclusions on basis of evidence).

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12. Obtaining information on where to get help on the teaching of science to children (workshops, extension courses, etc.).
13. Soliciting and utilizing student feedback for the purpose of improving science instruction.
14. Presenting science so that students arrive at principles from specific experiences.
15. Presenting science so that students discover facts for themselves.
16. Overcoming difficulties encountered in providing excursions outside the classroom (locating suitable places, transportation, approval, funds).

V. NEEDS RELATED TO MORE EFFECTIVE USE OF INSTRUCTIONAL MATERIALS
1. Procuring supplementary science books for students on appropriate grade levels.
2. More effective utilization of science instructional tools (textbooks, Focus on Science, teachers' manuals, supplementary reading materials, etc.).
3. Utilizing the library and its facilities so as to increase the student's ability to supplement classroom learning.
4. Utilizing audio-visual materials as instructional media (slides, film strips, television, projectors, transparencies, etc.).
5. Preparing instructional materials for general classroom use.
6. Preparing instructional materials for testing.
7. Preparing instructional materials for enrichment.
8. Obtaining special materials and equipment in order to provide more effective science teaching.
9. Obtaining suitable demonstration materials in order to provide more effective science teaching.
10. Obtaining help and advice from qualified people in order to provide more effective science teaching.
11. Obtaining free and inexpensive materials in order to provide more effective science teaching.
12. Obtaining living things for classroom use.
13. Finding places for excursions and field trips where natural physical principles can be illustrated (pulleys, quarries, weather stations).
14. Finding places for excursions and field trips where applied physical principles can be illustrated (airports, factories, garages, etc.).
15. Other needs relative to more effective use of instructional materials.

VI. NEEDS RELATED TO THE SELF-IMPROVEMENT OF THE SCIENCE TEACHER
1. Evaluating science materials as to their appropriate level using learning theory criteria.
2. Understanding the nature of science (what it is, how it functions. Its relevance for nonscientists. Its relation to the humanities and social sciences. Its impact on society: the moral and social responsibilities of its practitioners.).
3. Updating of present knowledge of content in the area of Biology.
4. Updating of present knowledge of content in the area of Earth Science.
5. Updating of present knowledge of content in the area of Chemistry.
6. Updating of present knowledge of content in the area of Physics.
7. Updating of present knowledge of content in the area of Mathematics.
8. Training in the effective classroom use of individualized instruction.
9. Training in the effective classroom use of inquiry or discovery teaching.
10. Developing confidence in conducting demonstrations.
11. Developing confidence in experimenting with materials such as gases, water, electricity.
12. Developing confidence in working with living things such as snakes, mice, spiders, lizards, bats.
13. Other needs relative to the self-improvement of the science teacher.

VII. NEEDS RELATED TO TEACHING THE MIDDLE SCHOOL SCIENCE COURSE OBJECTIVES

1. Guidance in teaching the objectives in the 7th Grade unit: "How Scientists Work."
2. Guidance in teaching the objectives in the 7th Grade unit: "Atmosphere"
3. Guidance in teaching the objectives in the 7th Grade unit: "Ecology and Conservation"
4. Guidance in teaching the objectives in the 7th Grade unit: "Astronomy"
5. Guidance in teaching the objectives in the 7th Grade unit: "Life Science"
6. Guidance in teaching the objectives in the 7th Grade unit: "Health"
7. Guidance in teaching the objectives in the 8th Grade unit: "Matter and Change"
8. Guidance in teaching the objectives in the 8th Grade unit: "Physics"
9. Guidance in teaching the objectives in the 8th Grade unit: "Energy"
10. Guidance in teaching the objectives in the 8th Grade unit: "Human Body"
11. Guidance in teaching the objectives in the 8th Grade unit: "Changing Earth"
12. Effectively using the Focus on Science modules to teach the course objectives.
13. Effectively using the "Activities" in the modules to teach the course objectives.
TO: STEERING COMMITTEE MEMBER
FROM: DAVID DGRAAF, COORDINATOR
DATE: NOVEMBER 19, 1979
RE: STEERING COMMITTEE MEETING

I would like to thank each one of you for your cooperation in distributing and collecting the needs questionnaires. I am happy to report that 38 science teachers out of a possible 48 have responded to the questionnaire so far. If you still have a completed questionnaire at your school please send it to the Math/Science Office.

Currently I am tabulating the results which I will present at our next committee meeting. Also, at that meeting I plan to discuss specific ideas for inservice activities that address those important needs generated by the questionnaire.

The next meeting is scheduled for next Monday, Nov. 26 at 3:30 P.M. in the "Lucy" conference room. I hope to see you there.

Sincerely,

MATH/SCIENCE DEPARTMENT 456-4960

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
TO: SCIENCE TEACHER  
FROM: DAVID DEGRAAF, PROJECT COORDINATOR  
DATE: NOVEMBER 1, 1979  
RE: MIDDLE SCHOOL/JUNIOR HIGH SCIENCE TEACHER  
PROFESSIONAL DEVELOPMENT PROJECT.

I am happy to report that the PROFESSIONAL DEVELOPMENT PROJECT has officially begun and is progressing well. A steering committee has been established to provide input as it relates to the needs and desires of science teachers in the middle school/junior high. The steering committee members are:

Walter Casper    West  
Larry Pegel      City  
Karyl Lessard    Harrison Park  
James Nicolette  Riverside  
Gary Sundin      Burton  
Phil Telman      Iroquois  
Alice Weschgel   Oakleigh

For the duration of the first semester, the committee and I will be assessing needs and planning inservice activities for second semester. Please feel free to talk to your steering committee representative regarding professional development ideas.

In the near future you will be receiving a questionnaire in which you will be asked to identify and select needs which are important to you, your school science department, and all science teachers in the school system. Your cooperation will be appreciated.

Sincerely,

[Signature]

MATH/SCIENCE DEPARTMENT  
456-4960

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SCIENCE TEACHER PROFESSIONAL DEVELOPMENT

RESULTS OF THE NEEDS ASSESSMENT

<table>
<thead>
<tr>
<th>Responding School</th>
<th>Number of Respondants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burton Junior High</td>
<td>8</td>
</tr>
<tr>
<td>Harrison Park Junior High</td>
<td>4</td>
</tr>
<tr>
<td>Iroquois Middle</td>
<td>7</td>
</tr>
<tr>
<td>Northeast Junior High</td>
<td>3</td>
</tr>
<tr>
<td>Oakleigh Middle</td>
<td>2</td>
</tr>
<tr>
<td>Riverside Junior High</td>
<td>6</td>
</tr>
<tr>
<td>West Middle</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>

Ten most important needs in the order of their importance.

1. Organizing science curriculum materials for more effective instruction.
2. Designing lab activities for more effective science instruction.
3. Sharing science teaching ideas with other science teachers.
4. Designing demonstrations for more effective science instruction.
5. Adapting the science curriculum to the appropriate achievement levels of the students.
6. Effectively evaluating and testing students' attainment of the course objectives.
7. Obtaining supplementary science books for students on appropriate grade levels.
8. Adapting the science curriculum to individual needs.
9. Overcoming difficulties encountered in providing field trips outside the classroom (locating suitable places, transportation, approval, funds, etc.).
10. Finding places for field trips where natural physical principles can be illustrated (quarries, weather stations, etc.).
TO:   STEERING COMMITTEE MEMBERS  
FROM: DAVID DEGRAAF, PROJECT COORDINATOR  
DATE: APRIL 10, 1980  
RE: DISTRIBUTION OF A PROFESSIONAL DEVELOPMENT SURVEY

In the process of developing a strategy for the inservice education of middle school/junior high science teachers, I feel it is essential to find out from them about their participation in and perceptions of inservice activities. This information will be collected using a questionnaire that I designed. The questionnaire is largely a checklist that can be completed in about 15 minutes.

As you did so effectively with the needs assessment last fall, I hope you will help in the distribution and collection of the survey within your school. I will meet with you soon to discuss this matter and also the status of the professional development project. Thanks for your help.

Sincerely,

David DeGraaf

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
You are no doubt aware that the middle school/junior high science teachers in Grand Rapids have been participating in a study during this past school year, concerning professional development. Specifically, the study deals with inservice education. Most of you began your participation by filling out the Science Teacher Needs Assessment. During the year some of you also participated in inservice activities that emerged partly because of responses to the Needs Assessment. This letter deals with the next step in the study.

A questionnaire has been developed to assess your past inservice education experiences and your opinions about those experiences. It is being sent to you through your steering committee representative with the hope that you will be able to provide this important information. The questionnaire is largely a checklist that can be completed in about 10 minutes.

Obviously the study and development of an inservice strategy depends on the expertise of persons such as yourself and the responses you are willing to supply. I can assure you that your responses will be kept completely confidential and a summary of the results will be sent to you when the study is complete.

I want to express my sincere thanks for any help you may give. I also hope that you will return the questionnaire promptly to your steering committee representative.

Sincerely,

David A. DeGraaf
Project Coordinator

As Chairman of Mr. DeGraaf's Doctoral Advisory Committee I endorse his efforts and hope sincerely that you will find it possible to participate.

George G. Mallinson
Distinguished Professor
of Science Education
Western Michigan University

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MEMORANDUM

Date May 12, 1980

To __________________________

At _________________________

From David DeGraaf, Project Coordinator

Subject Professional Development Survey

— AVOID VERBAL INSTRUCTION —

Just a reminder to encourage your science staff to complete the questionnaire as soon as possible.

Also, please mail all completed forms to the Math/Science Office c/o Bill Oosse.

Thanks for your help,
TO: STEERING COMMITTEE MEMBERS
FROM: DAVID DEGRAAF, PROJECT COORDINATOR
RE: PROFESSIONAL DEVELOPMENT SURVEY
DATE: MAY 20, 1980

I would like to thank you for your help in administering the Professional Development Survey. If you still have some completed forms, please send them in as soon as possible. I hope to have the results tabulated shortly, so I can send each teacher a summary.

Sincerely,

MATH/SCIENCE DEPARTMENT 456-4960
RESULTS OF THE SCIENCE TEACHER PROFESSIONAL DEVELOPMENT SURVEY

These results represent the responses of 35 junior high/middle school science teachers (73% of total).

A. GENERAL INFORMATION

1. Undergraduate academic major.
   a) Biology 49%
   b) Chemistry 9%
   c) Physics 2%
   d) Earth Science 11%
   e) Other 29%

2. Undergraduate academic minor.
   a) Biology 11%
   b) Chemistry 2%
   c) Physics 15%
   d) Earth Science 9%
   e) Other 63%

3. Levels of teaching certificate.
   a) K-12 14%
   b) K-8 9%
   c) 7-12 77%

4. Years of teaching experience.
   a) Less than 1 2%
   b) 1-3 9%
   c) 4-6 29%
   d) 7-9 24%
   e) 10-12 16%
   f) More than 12 18%

5. Other courses taught besides science.
   a) Science only 77%
   b) Other 23%

6. Grade level of classes.
   a) 7 38%
   b) 8 30%
   c) 9 30%
   d) 10-12 2%

7. Level preferring to teach.
   a) 7 21%
   b) 8 25%
   c) 9 12%
   d) 10-12 42%
B. INSERVICE EDUCATION EXPERIENCE

1. Highest level of education completed.
   a) Bachelor's 6%
   b) Bachelor's plus 37%
   c) Master's 34%
   d) Master's plus 23%

2. Most recent science or science education course taken for credit.
   a) Less than 1 year ago 23%
   b) 1-3 years ago 23%
   c) 4-6 years ago 23%
   d) More than 6 years ago 31%

3a. Most recent inservice activity that was related specifically to science teaching.
   a) Less than 1 year ago 37%
   b) 1-3 years ago 46%
   c) 4-6 years ago 6%
   d) More than 6 years ago 2%
   e) Never 9%

3b. Format of the inservice activity referred to in 3a.
   a) Continuing education course 9%
   b) Workshop 67%
   c) Conference/convention 15%
   d) Other 9%

   a) National Science Teachers Association (NSTA) 17%
   b) Michigan Science Teachers Association (MSTA) 14%
   c) Other 6%
   d) None 74%

5. Professional activities participating in.
   a) National Science Foundation Institute 14%
   b) National Science Teachers Association Convention 6%
   c) Michigan Science Teachers Association Convention 31%
   d) A local science curriculum committee 20%
   e) None of the above 48%

6. Subscribing to journals or periodicals that are related specifically to science teaching.
   a) Yes 29%
   b) No 71%

7. Reasons for participating in science teacher inservice activities
   (In order of importance).
   1) Professional growth
   2) Job promotion
   3) Salary increase
   4) Administrative pressure
8. Terms that best describe previous inservice experiences (in order of frequency of response).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1) Educational</td>
<td>6) Irrelevant</td>
</tr>
<tr>
<td>2) Worthwhile</td>
<td>7) Timely</td>
</tr>
<tr>
<td>3) Relevant</td>
<td>8) Wasteful</td>
</tr>
<tr>
<td>4) Applicable</td>
<td>9) Not applicable</td>
</tr>
<tr>
<td>5) Not timely</td>
<td>10) Noneducational</td>
</tr>
</tbody>
</table>

C. PERCEPTIONS OF INSERVICE EDUCATION

1. Levels of organization at which inservice education for science teachers should be conducted (in order of appropriateness).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1) Building/Department</td>
<td>4) County wide</td>
</tr>
<tr>
<td>2) Individualized</td>
<td>5) Statewide</td>
</tr>
<tr>
<td>3) System wide</td>
<td>6) Nationwide</td>
</tr>
</tbody>
</table>

2. Times for participating in inservice activities (in order of appropriateness).

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1) During school (released time)</td>
<td>4) Evenings</td>
</tr>
<tr>
<td>2) Immediately after school</td>
<td>5) Before school</td>
</tr>
<tr>
<td>3) Summers</td>
<td>6) Weekends</td>
</tr>
</tbody>
</table>

3. Desired frequencies for participation in inservice activities for science teachers (in order of appropriateness).

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1) Once a semester</td>
<td>4) A week or two in the summer</td>
</tr>
<tr>
<td>2) Once a year</td>
<td>5) Weekly</td>
</tr>
<tr>
<td>3) Monthly</td>
<td></td>
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</tbody>
</table>

4. Formats for inservice activities for science teachers (in order of appropriateness).

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<table>
<thead>
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</thead>
<tbody>
<tr>
<td>1) Workshops with high participant involvement</td>
<td></td>
</tr>
<tr>
<td>2) Demonstration lessons by other science teachers</td>
<td></td>
</tr>
<tr>
<td>3) Visits to other programs</td>
<td></td>
</tr>
<tr>
<td>4) College/University courses for credit</td>
<td></td>
</tr>
<tr>
<td>5) Time to attend conferences and/or conventions</td>
<td></td>
</tr>
<tr>
<td>6) Seminars offered by knowledgeable people</td>
<td></td>
</tr>
<tr>
<td>7) Sabbatical leave of absence</td>
<td></td>
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<tr>
<td>8) Newsletters and other publications</td>
<td></td>
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</tbody>
</table>

5. Locations for holding inservice meetings (in order of appropriateness).

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<table>
<thead>
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</thead>
<tbody>
<tr>
<td>1) Local school</td>
<td></td>
</tr>
<tr>
<td>2) Local college/university</td>
<td></td>
</tr>
<tr>
<td>3) A noneducational setting</td>
<td></td>
</tr>
</tbody>
</table>

6. Topics for inservice (in order of appropriateness).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1) Updating in science content</td>
<td></td>
</tr>
<tr>
<td>2) Recent discoveries in science</td>
<td></td>
</tr>
<tr>
<td>3) Science teaching methods</td>
<td></td>
</tr>
<tr>
<td>4) Science curriculum development</td>
<td></td>
</tr>
<tr>
<td>5) Testing/evaluating objectives</td>
<td></td>
</tr>
</tbody>
</table>
7. Roles for the science teacher in inservice activities (In order of appropriateness).
1) Active participant
2) Evaluator
3) Planner/Organizer
4) Presenter

8. Desired influence of people or organizations on science teacher inservice (In order of degree).
1) Science supervisor
2) Science department head
3) Professional science teacher associations (i.e. NSTA)
4) University science educators
5) State Department of Education
6) Building administration
7) Local bargaining association (i.e. GREA)

9. Actual influence of people or organizations on science teacher inservice (In order of degree).
1) Science supervisor
2) Science department head
3) Building administration
4) University science educators
5) Professional science teacher associations (i.e. NSTA)
6) State Department of Education
7) Local bargaining association

10. Influence of factors on willingness to participate in an inservice activity (In order of degree).
1) Time
2) Topic
3) Location
4) Presenter
5) Format
6) Previous experience
7) Financial incentives
8) Administrative encouragement
9) Peer pressure

11. Purposes for science teacher inservice education (In order of appropriateness).
1) Sharing teaching methods
2) Updating in content
3) Implementing curriculum
4) Choosing curriculum
5) Time
6) Previous experience
7) Financial incentives
8) Administrative encouragement
9) Peer pressure

12. Items to be included in a teachers' contract (In order of appropriateness).
1) Additional released time for inservice activities
2) Additional reimbursement for inservice expenses
3) Extending the school year for inservice activities
4) Extending the school day for inservice activities
Appendix C

Performance Objectives for
Junior-High/Middle-School Science Teachers
in the Grand Rapids Public School System
Course: 7th Grade Science

HOW SCIENTISTS WORK

Goal: To gain a basic understanding of tools, methods, and careers of science.

1. Each student will be able to write the numerical value associated with metric prefixes kilo-, centi-, milli-

2. Each student will be able to match the following eight (8) areas of science with their respective descriptions: astronomy, biology, chemistry, ecology, geology, meteorology, oceanography, physics.

3. Each student will be able to name the basic metric measurement unit for mass (weight), capacity (volume), length, and temperature.

4. Each student will be able to name one measuring device calibrated in metric units used for measuring mass (weight), capacity (volume), length, and temperature.

5. Each student will be able to demonstrate weighing an object to the closest gram.

6. Each student will be able to read a Celsius thermometer to the nearest degree.

7. Each student will be able to measure liquid capacity (volume) to the nearest milliliter using a 100 ml graduated cylinder.

8. Each student will be able to measure lengths to the nearest centimeter.

9. Each student will be able to differentiate between a law and a theory (not testable).

10. Each student shall be able to use a dichotomous leaf key to identify a common leaf.

11. Each student will be able to focus a microscope on a prepared slide using a low power.
Goal: To identify atmospheric changes and their effect upon the earth.

1. Given a list of the layers of the atmosphere, the student will identify troposphere as the one in which most weather conditions occur.

2. Given a map of the United States, each student will illustrate the prevailing winds.

3. Each student shall name and describe the three (3) basic cloud types, i.e., cumulus, cirrus, stratus.

4. Given a diagram showing the four (4) air masses (polar maritime, polar continental, tropical maritime, tropical continental) each student shall be able to either give their names or describe their relative temperature (warm or cold) and relative moisture content (wet or dry).

5. Given a diagram of a cross section of a warm front and a cold front, the student can identify each.

6. The student will be able to indicate what is measured by each of the following weather instruments: barometer, thermometer, hygrometer, wind vane, anemometer.

7. Each student will keep a one week daily record of local barometric pressure and explain its effect upon daily weather changes.

8. Given a weather map from a local newspaper, the student will identify highs, lows, fronts, area of precipitation, and isotherms.

9. Each student will describe how weather can affect industry, farming, travel, recreation, and construction (not testable - could be a class project).

10. Given two (2) air masses differing in any one of the following ways (moisture content, temperature, pressure), the student will be able to state the direction of the wind.

11. Each student will investigate one (1) career in meteorology and report his/her findings.
ECOLOGY AND CONSERVATION

Goal: To discover the relationships of organisms with their environment so that man can use his environment without endangering or destroying mankind, other organisms, and the natural resources of the earth.

1. Each student should be able to explain that green plants are basic to all life on earth because they produce oxygen and food.

2. Each student should be able to name the four (4) things necessary to maintain life (adequate temperature, moisture, light, nutrients).

3. Each student should be able to draw a labeled diagram of the common cycles which occur in nature (oxygen-carbon dioxide, water, nitrogen).

4. Each student should be able to name at least two (2) organisms which can be found in each of the following environments and explain why such an organism can live there: freshwater, woodlands, grasslands.

5. Each student should be able to construct a model of a food chain involving a fox, rabbits, bacteria, and clover, distinguishing between producers, consumers, and decomposers.

6. Each student should be able to name three (3) herbivores, three (3) carnivores, and three (3) omnivores and identify at least one (1) food item for each.

7. Each student should be able to identify an example of the following relationships found in nature: predator-prey, symbiosis, parasitism.

8. Each student should be able to identify examples of renewable and non-renewable resources and explain how to renew the renewables and conserve non-renewables.

9. Each student should be able to identify man-caused events which alter environments and give possible ways to preserve those environments.

10. The student will write a story about a tree in which he/she explains how it is adapted to a particular habitat, lists the environmental factors that serve its needs, identifies how the tree contributes to the balance of natural system of matter which sustains life on the earth (not to be tested on a computer scored test).

11. Each student will investigate one (1) career in the ecology/conservation field and describe his/her findings (to be teacher evaluated).
Goal: To gain an understanding of the components of the universe, their relationships and interaction.

1. Each student will be able to name and describe the rotation and revolution of the earth.

2. Each student will demonstrate understanding of rotation and revolution by matching one of them with each of the following:
   a. Causes day and night
   b. Causes change of length of day and night
   c. Causes seasonal changes
   d. Causes years to occur
   e. Causes changes in the angle of elevation of the sun

3. Each student will match "reflected light" or "luminous light" to the following objects: planet, moon, sun, star.

4. Each student will match the following with their descriptions: planet, meteorite, comet, sun, moon, asteroid, galaxy.

5. Each student will be able to list two (2) of the characteristics which are used to classify stars.

6. Each student will be able to name the planets in order from the sun.

7. Each student will be able to describe the path of the planets as an ellipse.

8. Each student will be able to name three (3) individuals and their significant contributions to the study of astronomy.

9. Each student will be able to name or describe three (3) benefits derived from the space program and space exploration.

10. Each student will investigate a career related to astronomy and report his/her findings.
LIFE SCIENCE

Goal: To understand the structure and function and classification of some living things and how they relate to the existence of humans.

1. Given a diagram of a plant cell, each student will be able to label the cell wall, cytoplasm, cell membrane, chloroplasts, nucleus.

2. Each student will be able to distinguish between sexual and asexual reproduction.

3. Each student will be able to name at least three (3) life activities common to all living things.

4. Each student will list two (2) ways in which bacteria are beneficial and/or harmful to humans.

5. Each student will list two (2) ways in which algae are beneficial and/or harmful to humans.

6. Each student will list two (2) ways in which fungi are beneficial and/or harmful to humans.

7. Each student will list two (2) ways in which molds are beneficial and/or harmful to humans.

8. Each student will be able to give an example of a flowering plant and a non-flowering plant.

9. Each student will be able to make a drawing of a cross-section of a leaf and label the following: stomate, guard cell, cuticle, vein, chloroplast.

10. Given a cross section of a tree trunk or a diagram showing such a cross section, each student will estimate its age.

11. Given the following seven (7) groupings in the animal kingdom, the student will be able to name two members in each group: spiders, insects, amphibians, reptiles, birds, fish, mammals.

12. Each student will investigate one career related to plants or animals (not including humans) and report on his/her findings.
HEALTH.

Goal: The student should realize that good health depends upon living in an environment in which good air, pure water, and wholesome food exist; and in which communicable diseases and pollution are absent.

1. Each student should be able to list a sign or symptom of the following: influenza or common cold, cancer, heart disease, measles, acne, strep throat, ulcer.

2. Each student should be able to list the cause (or one of the causes) of influenza or common cold, cancer, heart disease, measles, acne, strep throat, ulcer.

3. Each student should be able to list a common cure (or preventative measure) for influenza or common cold, cancer, heart disease, measles, acne, strep throat, ulcer.

4. Each student should list a method of prevention for influenza or common cold, cancer, heart disease, measles, acne, strep throat, ulcer and explain why that prevention is successful.

5. Each student should be able to explain what a drug is, name one drug, and explain how it is used in the treatment of a disease.

6. Each student should be able to explain what drug abuse is, name the three most commonly abused drugs (tobacco, alcohol, caffeine) and explain the effects of such abuse.

7. Each student should be able to give one use for each of the following in the human body: fats, carbohydrates, proteins, vitamins, water, salts.

8. Each class will participate in a discussion of bodily changes during puberty (not testable).

9. Each student should be able to identify one procedure for proper
   a. oral hygiene (brushing or flossing).
   b. external hygiene (bathing, nails and hair, clean clothes, deodorant).

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Course: 8th Grade Science

MATTER AND CHANGE

Goals: To describe matter and discover why matter behaves as it does under specific conditions.

1. Each student will be able to distinguish between matter and energy.
2. Each student will be able to name four (4) properties of any given object.
3. Given an assortment of objects, the student will classify them twice, using one or more differing physical and/or chemical properties for each classification (e.g., color, hardness, states of phases, conductivity, etc.).
4. Each student will name the three (3) states of phases of matter and match each phase with its molecular motion, volume, and shape.
5. Given a list of six (6) changes in matter, the student will be able to correctly determine whether the change was physical or chemical in at least four (4) of the changes.
6. Given a periodic chart, the student will be able to identify an element's symbol, atomic number, atomic weight, and electron configuration.
7. Given a periodic chart, each student will draw a model of the oxygen atom complete with its protons, neutrons, and electrons.
8. Each student will investigate one career in the chemistry field and describe his/her findings (to be teacher evaluated).

PHYSICS

Goal: To gain a basic understanding of matter in motion and the interaction of the forces involved.

1. Given an explanation of each of Newton's three (3) laws, a student can give one example of each.
2. Given a definition of mass and weight, each student can identify them.
3. Each student will be able to match the following terms with their definitions: force, work, velocity, speed, acceleration.
4. Each student will match the following forces with their descriptions: gravitation, magnetism, friction, centripetal force, cohesion, adhesion.
5. Each student will investigate a career in physics and report his findings.
ENERGY

Goal: To describe the mechanics of energy and its present and future uses.

1. Each student should be able to list at least five (5) forms of energy and identify a use of each.

2. Given an example of energy, each student should be able to determine whether it is potential or kinetic energy.

3. Each student should be able to construct or diagram a simple electrical circuit including a power source, switch, wires and a lamp or bell or motor.

4. Each student will construct or diagram an electro-magnet and identify one use for it.

5. Each student will be able to identify conduction, connection, and radiation as heat transfer methods and give one example of each.

6. Each student will be able to identify at least one example of refracted and reflected light.

7. Given coal, oil, natural gas, and nuclear energy as today's common energy sources, the student should be able to identify at least one advantage and one disadvantage of each.

8. Each student shall identify at least three (3) additional energy sources which could be used in the future and identify an advantage and disadvantage of each.

9. Each student will investigate one energy related career and report his/her findings.
HUMAN BODY

Goal: To gain a general understanding of the major structural parts of the body as well as how the body functions.

1. Given a drawing of an animal cell, each student will be able to label the cell membrane, protoplasm, and nucleus.

2. Each student will be able to name seven (7) of the ten (10) systems found in the human body.

3. Given a list of the ten (10) systems of the human body, each student will be able to identify at least one (1) organ in each.

4. Given a list of the ten (10) systems of the human body, each student will be able to identify one (1) function of each.

5. Each student will investigate one (1) career dealing directly with the human body and report his/her findings.

6. Each student will list at least five (5) careers relating to the human body.

CHANGING EARTH (GEOLOGY & OCEANOGRAPHY)

Goal: To gain an understanding of the earth, its composition, its change processes, and its future directiveness.

1. Each student will be able to list three (3) examples of the ocean's utility to mankind.

2. Each student will be able to list the three (3) basic rock types and explain how each type was formed.

3. Each student will be able to give a causal explanation for the occurrence of tides.

4. Given a diagram of the ocean floor, the student will label continental shelf, slope, abyss, and ridge.

5. Each student will be able to list volcanism, earthquakes, weathering, erosion, and continental drift as basic forces which work to change the earth's surface.

6. Each student will be able to name two (2) examples of each of the following rock types: sedimentary, igneous, and metamorphic.

7. Each student will be able to construct a diagram to illustrate a rock cycle.

8. Each student will investigate one career in either geology or oceanography and report his/her findings.
Bibliography

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