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The influence of preservice background on teaching behaviors of middle school science teachers

Pontius, Richard W., Ph.D.
The Ohio State University, 1993
THE INFLUENCE OF PRESERVICE BACKGROUND
ON TEACHING BEHAVIORS OF
MIDDLE SCHOOL SCIENCE TEACHERS

DISSERTATION
Presented in Partial Fulfillment of the Requirements
for the Degree
Doctor of Philosophy in
the Graduate School of The Ohio State University

By

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The Ohio State University
1993

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Advisor
College of Education
To My Parents
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>VITA</td>
<td>v</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>x</td>
</tr>
</tbody>
</table>

## CHAPTER

<table>
<thead>
<tr>
<th>I. Introduction</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>The need for study</td>
<td>1</td>
</tr>
<tr>
<td>The research question</td>
<td>7</td>
</tr>
<tr>
<td>Problem 1</td>
<td>7</td>
</tr>
<tr>
<td>Problem 2</td>
<td>8</td>
</tr>
<tr>
<td>Problem 3</td>
<td>8</td>
</tr>
<tr>
<td>Problem 4</td>
<td>8</td>
</tr>
<tr>
<td>Definition of terms</td>
<td>9</td>
</tr>
<tr>
<td>Limitations</td>
<td>11</td>
</tr>
<tr>
<td>Assumptions</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. Review of the Literature</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching characteristics of middle school</td>
<td>15</td>
</tr>
<tr>
<td>teachers</td>
<td></td>
</tr>
<tr>
<td>Middle level teacher preparation</td>
<td>24</td>
</tr>
<tr>
<td>Teacher preparation programs</td>
<td>30</td>
</tr>
<tr>
<td>My Class Inventory (MCI)</td>
<td>33</td>
</tr>
<tr>
<td>Science attitude</td>
<td>36</td>
</tr>
<tr>
<td>Summary</td>
<td>41</td>
</tr>
</tbody>
</table>
### III. Methods and Procedures

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>43</td>
</tr>
<tr>
<td>The population</td>
<td>44</td>
</tr>
<tr>
<td>The study</td>
<td>45</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>48</td>
</tr>
<tr>
<td>Development of the attitude instrument</td>
<td>50</td>
</tr>
<tr>
<td>Qualitative data</td>
<td>53</td>
</tr>
<tr>
<td>Analysis</td>
<td>55</td>
</tr>
<tr>
<td>Procedures</td>
<td>56</td>
</tr>
</tbody>
</table>

### IV. Results

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating School Districts</td>
<td>62</td>
</tr>
<tr>
<td>Participating teacher profiles</td>
<td>63</td>
</tr>
<tr>
<td>Teacher E1</td>
<td>63</td>
</tr>
<tr>
<td>Teacher E2</td>
<td>64</td>
</tr>
<tr>
<td>Teacher E3</td>
<td>65</td>
</tr>
<tr>
<td>Teacher E4</td>
<td>65</td>
</tr>
<tr>
<td>Teacher E5</td>
<td>66</td>
</tr>
<tr>
<td>Teacher S1</td>
<td>66</td>
</tr>
<tr>
<td>Teacher S2</td>
<td>67</td>
</tr>
<tr>
<td>Teacher S3</td>
<td>67</td>
</tr>
<tr>
<td>Teacher S4</td>
<td>68</td>
</tr>
<tr>
<td>Teacher S5</td>
<td>68</td>
</tr>
<tr>
<td>Participating administrator profiles</td>
<td>69</td>
</tr>
<tr>
<td>Administrator A1</td>
<td>69</td>
</tr>
<tr>
<td>Administrator A2</td>
<td>70</td>
</tr>
<tr>
<td>Administrator A3</td>
<td>70</td>
</tr>
<tr>
<td>Quantitative Data-MCI and Attitude Instrumentation</td>
<td>72</td>
</tr>
<tr>
<td>Qualitative Data-Teacher Interviews</td>
<td>83</td>
</tr>
<tr>
<td>Qualitative Data-Administrator Interviews</td>
<td>117</td>
</tr>
<tr>
<td>Qualitative Data-Classroom Behavior</td>
<td>128</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Desirable Middle School Teacher Characteristics.</td>
<td>22</td>
</tr>
<tr>
<td>3. Important teaching behaviors for effective middle school teaching as identified by authors and researchers.</td>
<td>25</td>
</tr>
<tr>
<td>4. Selected schools with hours of science requirements in elementary and secondary science certification programs.</td>
<td>33</td>
</tr>
<tr>
<td>5. Alpha reliabilities of MCI as reported by Fisher and Fraser (1981), from the pilot study of Spring 1991, and this study Spring 1992.</td>
<td>49</td>
</tr>
<tr>
<td>6. Factor loadings for the attitude instrument by scale</td>
<td>52</td>
</tr>
<tr>
<td>7. Alpha Reliabilities from Attitude toward science class, Attitude toward science, and Attitude toward science as a cooperative endeavor scales.</td>
<td>53</td>
</tr>
<tr>
<td>8. Summary of characteristics of participating teachers.</td>
<td>71</td>
</tr>
<tr>
<td>9. Comparison of Mean MCI Scale Scores and t-values by Science Teacher Certification Type.</td>
<td>73</td>
</tr>
</tbody>
</table>
10. Comparison of Mean Attitude Scale Scores and t-values by Certification Type of Participating Teachers. ....... 74

11. Comparison of mean scores on the Satisfaction with Science Class Scale of the MCI by teacher. ............ 76

12. Comparison of mean scores on the Friction in Science Class Scale of the MCI by teacher. ................. 77

13. Comparison of mean scores on the Difficulty in Science Class Scale of the MCI by teacher. .............. 78

14. Comparison of mean scores on the Cohesion in Science Class Scale of the MCI by teacher. .............. 79

15. Comparison of mean scores on the Attitude Toward Science Class Scale of the attitude instrument by teacher. .. .. 81

16. Comparison of mean scores on the value of science of the attitude instrument, by teacher, based on 8 items ...... 77

17. Important teaching behaviors for effective middle school teaching as identified by authors, researchers and teachers in the study .......................... 115

18. Frequency and category of classroom behaviors observed during classroom visitations. ................. 130

19. Frequency and category of classroom behaviors observed during classroom visitations for individual teachers. .... 131

20. Average number of activities per teacher during classroom observations. .................. 133
Chapter I

Introduction

Need for study:

In the United States, middle school teachers commonly come from one of two preservice certification backgrounds: secondary or elementary education. Mechling, Stedman, and Donnellan (1982) noted that 44 states certify teachers in K-6, K-8, or 1-8, all of which cover at least one of the middle grades. Additionally they note that 20 states permit teachers with secondary certification to teach in middle school or junior high school. Thirty states make no differentiation between junior and senior high school certification. Only 22 states have specific middle school certification requirements (Adolescent Pregnancy Prevention Clearinghouse, 1988). For example, in Wyoming middle school certification requires specific middle level oriented coursework beyond a secondary or elementary certification; the preparation is not a separate curriculum.
What characteristics contribute to the preparation of an effective middle school teacher? Are these characteristics different from those that produce an effective elementary or high school teacher? Fraser, Tobin, and Lacy (1988), using the My Class Inventory (MCI) to measure aspects of the learning environment, found that students in exemplary elementary and middle school science classes viewed their classes more favorably than students in comparison classrooms. On four of the five MCI scales the difference between mean scores for exemplary classrooms and comparison classrooms was one standard deviation or greater. Student ratings using the MCI indicated that exemplary teachers had classrooms that were more cohesive, less difficult, less competitive, had less friction, and produced greater satisfaction for the students.

Buckner and Bickel (1991) in a survey of middle school students found that when looking at teachers from what Buckner and Bickel term a professional viewpoint students rated strong knowledge of subject matter the most important. Following in importance in descending order were: checking to make sure students understand, being fair when grading, and being aware that some students need extra help. Surveys such as these seem to confirm the value of a strong
preparation in subject matter for middle school science.

The study by Buckner and Bickel (1991) also looked at the personal characteristics of teachers. Teachers rated highest by students were those teachers who: 1) are willing to listen; 2) are respectful toward students; 3) accept students; and 4) are easy to talk to. McPartland (1990) suggests that elementary teachers have a more student centered approach than secondary teachers. The Buckner and Bickel survey rating important teacher descriptors from student interviews, suggests that elementary trained teachers could be more effective, if they actually use a more student centered approach.

Bush (1986), using data from the Comprehensive Tests of Basic Skills, found that the greatest gains in achievement occurred among students whose teachers were certified in both elementary and middle school science. It seems logical that teachers with combined certification would use the student centered orientation suggested by McPartland (1990) with the science knowledge needed for content mastery mentioned by Tobin and Fraser (1990).

Wiles and Bondi (1981) identified five basic needs they believe typical of students during the
middle school years. They identify these as:

1. The need to be safe and free of threat.
2. The need to be loved.
3. The need to be part of a group with identification and acceptance.
4. The need to be recognized.
5. The need to be independent.

Which preservice program enables teachers to meet these perceived needs of middle school students? What should be incorporated into a program preparing teachers to teach in middle school? McEwin (1984), citing a number of middle school experts including: Koos, (1927); Vars (1969); Compton (1973); McEwin (1983); George and McEwin (1978); Alexander and McEwin (1982) suggested that middle school programs include the following components: 1) complete knowledge of transescents; 2) middle level curriculum and instruction emphasis; 3) concentrations in at least two general undergraduate areas such as science and mathematics within a broad academic background; 4) specialized methods and reading courses; 5) field experience in good middle level schools, starting early and continuing during student teacher preparation. Eichhorn (1966) used the term transescent to describe middle school students in transescence. He defined transescence as:

The stage of development which begins prior to the onset of puberty and extends through the early stages of adolescence. Since puberty does not
occur for all precisely at the same chronological age in human development, the transescent designation is based on the many physical, social, emotional, and intellectual changes in body chemistry that appear prior to the puberty cycle to the time in which the body gains a practical degree of stabilization over these complex pubescent changes.

McEwin (1984) suggested that middle school teachers should be more academically specialized than teachers with elementary preparation and at the same time that preparation should be different than what is required for secondary teachers. Winchester (1981) mentions that educators agree that course offerings need to give future middle school teachers information in the following areas:
1) a broad general education; 2) depth of knowledge in at least two teaching fields; 3) attributes of early adolescents; 4) teaching of reading; 5) teachers' role as a counselor; 6) history and philosophy of middle schools; and 7) student teaching in middle schools.

More recently it was suggested that middle school curriculum should be based on general education rather than distinct specializations (Beane 1990). For this to happen the nature of middle school teacher education as well as teacher certification will have to be altered.

Integrating current research information The
Carnegie Council on Adolescent Development (1989) found that transformation of middle level education required eight essential principles:

1. Large middle grade schools are divided into smaller communities for learning.

2. Middle grade schools transmit a core of common knowledge to all students.

3. Middle grade schools are organized to ensure success for all students.

4. Teachers and principals have the major responsibility and power to transform middle grade schools.

5. Teachers for the middle grades are specifically prepared to teach young adolescents.

6. Schools promote good health; the education and health of young adolescents are inextricably linked.

7. Families are allied with school staff through mutual respect, trust, and communication.

8. Schools and communities are partners in education young adolescents.

The Carnegie Council states that this will require teachers “selected and specially educated to teach young adolescents.” Specifically they mention that middle level teachers should be expert at teaching young adolescents, be able to work as a team, be knowledgeable of how to serve as an advisor, and be knowledgeable of a solid core of information in one or more subject areas. The Carnegie Council further
suggests that prospective middle level teachers have a paid apprenticeship or internship following undergraduate education. Considering that currently most states do not have educational programs that aim specifically at the middle level, studies that look at the interaction of elementary and secondary preparatory programs are needed to evaluate the interaction of educational variables at the middle level.

**Research Question**

The majority of middle school science teachers come from either an elementary preservice background or a secondary science preservice background. How does science teacher preparatory background relate to effectiveness in teaching middle school science? Additionally, how do other teacher characteristics such as teaching experience and additional coursework impact the relationship between teacher preservice background and effectiveness in teaching middle school science?

**Problem 1:** How do middle school science teachers perceive their preservice background both in science and in pedagogical techniques?

**Sub Problem A:** Will teachers from a nonscience
background perceive their science background as adequate for teaching middle school science?

Sub Problem B: Will teachers from different preservice backgrounds perceive teaching differences between the two preparatory backgrounds?

**Problem 2:** Will student perception of the learning environment be related to the preparatory background of the teacher?

**Problem 3:** What teaching characteristics do middle school science teachers rate as the most effective in creating a positive learning environment?

**Problem 4:** What differences in teaching behaviors exist between teachers with elementary and teachers with secondary preservice preparation?

Sub Problem A: What is the relationship between teaching behaviors and preservice background?

Sub Problem B: Are differences in teaching behaviors perceived to diminish with time?
Definition of terms:

Terms related to education often have multiple meanings which can lead to confusion unless words are defined in advance. The competence or effectiveness of the teacher is directly related to teaching characteristics. Johnston and Markle (1986) define the competent teacher as ". . . . a self-confident 'personable' professional who demonstrates awareness of both student needs and varied learning strategies." Operationally, teacher competency or effectiveness in middle school science is defined by student scores on an inventory that measures the classroom learning environment. One meta-analysis (Haertel, Walberg, & Haertel, 1981) found a consistent relationship between student perceptions of the learning environment and cognitive, affective, and behavioral outcomes.

Attitude toward science was defined by Koballa (1985) who said that "There is now widespread consensus that the term attitude toward science should be used to refer to a general and enduring positive or negative feeling about science." Attitude toward science is operationally defined by student scores on an original attitude instrument designed to measure middle level student attitudes toward science.
Teacher preparatory background is defined as either elementary or secondary depending on the type of state certification held.

Teacher effectiveness for this study is defined as student perceptions of the classroom learning environment as measured by student scores on the My Class Inventory and teacher exhibition of those teaching traits considered important for middle school teaching as observed during classroom observations.

Experience level is considered to be the total number of years a teacher has been teaching regardless of grade level.

Additional coursework will be considered to be additional science courses that the teacher has completed on a college campus after certification and prior to this study. Inservice workshops are defined as school district sponsored courses in science not offered on a college campus.

Middle school is defined as grades six through eight, the most common configuration for middle school structure (in Alexander and McEwin, 1988). Alexander and George (1981) state that middle schools should be characterized by:

- School guidance systems in which each student has a counselor who knows him/her well and with whom the student can consult on academic, social, and personal matters.
- A transitional curriculum which provides
for careful articulation and coordination of learning experiences.
- Daily schedules organized into blocks of instructional time to allow for interdisciplinary instruction and appropriate learning experiences.
- Use of a variety of instructional strategies that have been demonstrated to be effective with early adolescents (such as cooperative learning, interdisciplinary instruction, team teaching).
- A wide range of exploratory courses designed to develop student interests, and an emphasis on intermural athletics which encourages participation by all students.
- A core of learning experiences appropriate to early adolescents focused on learning skills that students will need for future study.

Harnett (1991) states that "Grades 6-8 middle school arrangement has been found to be more likely to incorporate these six elements than programs that include grade 6 in the elementary school and grades 7 and 8 in a junior high school." Harnett goes on to mention that grade division does not separate a middle school from a junior high. For this to happen she says that "Its curriculum and organization must be geared to serve students in the 10-14 age range."

Limitations

The population of teachers was not randomly selected, but consisted of a purposeful selection based on their participation in a curriculum development program and type of certification held.
Because the target population was not randomly selected, it is possible that it may be atypical of the overall population of middle school science teachers. A second limitation is that teacher selection was based on the need to balance certification types to insure that there would be an equal representation of secondary and elementary certified teachers. Additionally, the inability to assign students to teachers in a random manner is a limitation. It is possible that such assignments were, in fact, handled randomly, but it seems unlikely that student-teacher assignments were completely random considering the number of students and teachers involved and the typical scheduling needs of most school districts.

**Assumptions**

Six of the ten participating teachers were participants in the Integrated Science Curriculum Project for Central Ohio Middle Schools. Although there is no reason to believe that the populations of schools sampled was significantly different from other urban and suburban populations, generalizability will be limited to those schools taking part in the study. Considering the largely qualitative nature of the
study this should not be considered a drawback.

The My Class Inventory was administered by classroom teachers. Discussions with principals during the pilot testing phase indicated that this was less disruptive to classes than researcher administered testing since teachers could administer the instruments at their convenience and classes were not subjected to the novelty of a researcher in the classroom. The schools in the accessible population were all urban, suburban or medium to large rural areas and were not representative of small rural settings.
Chapter II

Review of the Literature

The characteristics that contribute to a successful school at any single level show significant commonality across all levels while each level retains its own unique characteristics. Merenbloom (1988) suggested that an effective middle school:

1. Features a program that responds to the physical, intellectual, social-emotional and moral needs of early adolescents.

2. Has a set of documents to guide all aspects of the program.

3. Possesses a definite curriculum plan that includes organized knowledge, skills, and personal development activities.

4. Has a clearly established program of studies based upon the concept of exploration and provides opportunities for student growth.

5. Builds on the strengths of elementary education and prepares students for success in high school.

6. Employs teachers who focus on the learning needs of pupils by using appropriate teaching strategies.
7. Creates teaching teams using blocks of time to best deliver the instructional program.

8. Emphasizes the guidance and counseling function of staff members by providing for a home-base program, stressing the importance of self-concept, and providing a positive climate.

9. Promotes flexibility in implementing the daily, weekly, and monthly schedule to meet the varying needs of students.

10. Actively involves parents in various aspects of the school experience.

11. Evaluates the program on a regular basis and makes changes that enhance the learning.

These characteristics show considerable commonality with characteristics from The Carnegie Council (1989) listed in Chapter 1 (page 6), but are more comprehensive. AAAS (1989) recommends that science in schools be taught in a manner consistent with the nature of scientific inquiry. AAAS suggests that teachers of science should:

1. Start with questions about nature
2. Engage students actively
3. Concentrate on the collection and use of evidence
4. Provide historical perspectives
5. Insist on clear expression
6. Use a team approach
7. Do not separate knowing from finding out
8. Deemphasize the memorization of technical vocabulary

AAAS suggests that teaching should reflect
scientific values. These values may not be unique to science, but are highly valued in scientific endeavors. AAAS suggests that science teachers should try to:

1. Welcome curiosity
2. Reward creativity
3. Encourage a spirit of healthy questioning
4. Avoid dogmatism
5. Promote aesthetic responses

In the classroom the characteristics of each individual teacher dictate how well these ideal characteristics are integrated within the curriculum.

Teaching characteristics of middle school teachers.

Although the qualities needed by an effective middle school teacher frequently overlap those required at any level of education, a number of teacher characteristics appear more important at that level. Knowledge of teacher characteristics that are more important at the middle level could be used to guide preservice experiences of future teachers. In addition, identification of characteristics exhibited by effective teachers could be important in evaluation of existing preservice preparation programs. Finally, middle school certification standards could be developed to reflect those teacher characteristics
most important at that level.

Johnston and Markle (1986) noted that useful findings in the area of effective teachers are those that focus on clusters of teaching behaviors rather than on single, isolated ones. They point out that interactions between behaviors create complex patterns and that care should be taken not to attribute results to specific behaviors in isolation from other behaviors. They have grouped clusters of teacher behaviors under eighteen "competencies." In summary Johnston and Markle (1986) found that:

**Effective middle school teachers.**

1) *have a positive self concept.* They identify with others, feel adequate, trust themselves, and see themselves as worthy and likable.

2) *demonstrate warmth.* Teachers who seek contact with students, use affectionate words, smile and look pleasant are generally regarded as more effective.

3) *are optimistic.* More effective teachers express positive attitudes and pleasant feelings in the classroom.

4) *are enthusiastic.* Effective teachers are vigorous in their presentations and involved in the activities of the class.

5) *are flexible.* These teachers can change the focus in the middle of a lesson if the students become bored or disinterested; they adjust easily to changes in plans, time schedules, absence or student behavior; they respond to constructive requests for changes in classroom procedure.

6) *are spontaneous.* Spontaneous teachers can capitalize on unexpected incidents that arise in class.

7) *accept students.* Accepting teachers avoid criticism, not refusing to tell a student he or she is wrong, but by using sincere and frequent statements of approval.

8) *demonstrate awareness of developmental*
levels. They assign tasks appropriate to a student’s ability and adjust tasks when students become confused or uncertain.

9) . . .demonstrate knowledge of subject matter. Knowledgeable teachers are able to structure lessons and alter instruction on the basis of student needs.

10) . . .use a variety of instructional activities and materials. These teachers are able to vary instruction in accordance with individual student learning styles.

11) . . .structure instruction. Teachers who spend time discussing, explaining and stimulating cognitive processes in organized ways encourage greater pupil performance.

12) . . .monitor learning. These teachers check test papers and student work in order to adjust instruction.

13) . . .use concrete materials and focused learning strategies. These teachers use models, objects and visual aids to provoke imagery; attend to the manipulation of concrete images before moving to formal operations; and focus student attention on problem-solving situations.

14) . . .ask varied questions. Using both higher order and lower order questions, in appropriate situations, produces improved student performance.

15) . . .incorporate indirectness in teaching. Indirect teachers build on student statements, praise students, encourage student talk, and minimize criticism, lecture and confusion.

16) . . .incorporate “success-building” behavior in teaching. Success-oriented teachers use positive reinforcers, encouragement, and praise of student work.

17) . . .diagnose individual learning needs and prescribe individual instruction. More effective teachers monitor the completion of tasks, perceive various learning rates and allow adequate time for completion.

18) . . .listen. Teachers who listen to students attend to and build upon student thoughts and expressions.

The resulting middle school teacher should be one who has an awareness of student needs and learning strategies and is also a self-confident professional.
Using middle school teaching characteristics identified from several sources, Buckner and Bickel (1991) interviewed three hundred ninety-four middle school students from central Kentucky to discover their perceptions of what makes an effective middle school teacher (Table 1).

Identified middle school teaching characteristics were primarily derived from Johnston and Markle's 1986 summary of research on effective middle school teaching (Table 2), but interviews by Beane and Lipka (1987 as cited in Buckner & Bickel, 1991) provided four teaching characteristics. Additional characteristics came from the Buckner and Bickel's experience teaching at the middle level and from an adolescent daughter of one of them.

Characteristics were categorized by the authors as either professional relating to teaching, or personal relating to general characteristics of the teacher independent of teaching. Middle school students were interviewed individually by trained graduate and undergraduate students. The five professional characteristics that middle school students rated as most important were: knowing the subjects they are teaching, checking for student understanding, fairness in grading, knowing that some students need extra help, and taking more time to
Table 1

*Characteristics of excellent teachers (as perceived by students) from Buckner and Bickel (1991).*

*Most important to least important.*

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<thead>
<tr>
<th>Excellent teachers:</th>
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</thead>
<tbody>
<tr>
<td>1. are willing to listen</td>
</tr>
<tr>
<td>2. are respectful toward students</td>
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<tr>
<td>3. accept students</td>
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<tr>
<td>4. are easy to talk with</td>
</tr>
<tr>
<td>5. demonstrate warmth and kindliness</td>
</tr>
<tr>
<td>6. are friendly</td>
</tr>
<tr>
<td>7. are enthusiastic</td>
</tr>
<tr>
<td>8. are optimistic</td>
</tr>
<tr>
<td>9. are flexible</td>
</tr>
<tr>
<td>10. are humorous</td>
</tr>
<tr>
<td>11. are spontaneous</td>
</tr>
<tr>
<td>12. look like they feel good about themselves</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. really know the subjects they teach</td>
</tr>
<tr>
<td>2. check to make sure that all students understand</td>
</tr>
<tr>
<td>3. are fair when grading</td>
</tr>
<tr>
<td>4. are aware that some students need extra help</td>
</tr>
<tr>
<td>5. take more time for those who need it when explaining things</td>
</tr>
<tr>
<td>6. make sure students have success when beginning new material</td>
</tr>
<tr>
<td>7. are easy to understand</td>
</tr>
<tr>
<td>8. are careful to correct students who do not pay attention</td>
</tr>
<tr>
<td>9. are well organized for class</td>
</tr>
<tr>
<td>10. use a variety of material and activities in class</td>
</tr>
<tr>
<td>11. are available when the students need to speak to them</td>
</tr>
<tr>
<td>12. are careful to compliment students for doing a good job</td>
</tr>
<tr>
<td>13. do not use the textbook each and every day</td>
</tr>
<tr>
<td>14. ask easy, average, and difficult questions</td>
</tr>
<tr>
<td>15. let students have some say in the homework assignments</td>
</tr>
</tbody>
</table>
explain to those who need it. The most frequently named personal characteristics of an effective middle school teacher as identified by his or her students were: willing to listen, respectful toward students, accepting of students, easy to talk with, and demonstrating warmth and kindness. They noted that students consistently rank these five qualities as most important.

Johnston and Markle (1986) published a research-based listing of behavioral clusters characteristic of effective middle school teachers (Table 1). Using Johnston and Markle’s list as well as additional characteristics from other sources Buckner and Bickel (1991) surveyed middle school students to learn which characteristics the students thought most typical of an effective middle school teacher (Table 2).

Synthesizing the results of seven case studies done principally at the middle level, Tobin and Fraser (1990) looked at teaching characteristics that contributed to excellence in teaching. The studies were primarily qualitative involving teachers identified most frequently by administrators as being “above average.” Although studied exemplary teachers demonstrated significant diversity in methods, data from the synthesis of these studies helped Tobin and Fraser identify four traits consistent with exemplary
teachers. They found that exemplary science teachers:

1. Used management strategies that facilitated sustained student engagement.
2. Used strategies designed to increase student understanding of science.
3. Utilized strategies that encouraged students to participate in learning activities.
4. Maintained a favorable classroom learning environment.

Table 2

Desirable Middle School Teacher Characteristics.

Effective Middle School Teachers have these Characteristics

1. Positive self concept
2. Demonstrate warmth
3. Are optimistic
4. Are enthusiastic
5. Are flexible
6. Are spontaneous
7. Accept students
8. Demonstrate awareness of developmental levels
9. Demonstrate knowledge of subject matter
10. Use a variety of instructional activities and materials
11. Structure instruction
12. Monitor learning
13. Use concrete materials and focused learning strategies
14. Ask varied questions
15. Incorporate indirectness in teaching
16. Incorporate "success building" behavior in teaching
17. Diagnose individual learning needs and prescribe individual instruction
18. Listen-attend to what the students say
The use of management strategies by exemplary teachers produced classes with high levels of efficiency. Few behavior problems were noted although students worked independently and in groups. Most exemplary teachers were concerned with having students learn with understanding. In the high school this often took the form of concrete exemplars for abstract concepts while at the elementary level activities tended to be used to solve problems. Strategies were utilized to encourage student involvement in learning activities. Class activities tended to be organized to encourage student participation by providing an atmosphere relatively free of embarrassment. Student impressions of the classroom environment as measured by a short form of the Classroom Environment Scale (CES) in classrooms of exemplary teachers tended to be more favorable than in classrooms of comparison groups. Student perceptions of the classroom environment were particularly divergent on scales measuring involvement, teacher support, and order and organization. A comparison of information from the three studies may be found in Table 3.
Middle level teacher preparation

Inservice teachers' knowledge and opinions of theory on curriculum and teaching strategies was the subject of the study done by Sparapani, Abel, Edwards, and Herbster, (1991) for guidance in reform of middle school teacher preparation programs. They surveyed a total of one hundred thirty-six middle level teachers from Alabama, Georgia, Michigan, and Pennsylvania. Most of the teachers surveyed believed that middle level classrooms should have structured classroom management systems, that students should have knowledge of cooperative and collaborative learning processes, and that students should receive frequent opportunities to practice written and oral communication. There was general consensus on the following points: it is more important for students to learn to cooperate than to learn to compete; team and interdisciplinary teaching is important; a mixture of lecture/discussion and group oriented activities should be used to teach middle level students; and it is difficult to interest students in school work. The teachers agreed that although they use group activities middle level students do not work well in
Table 3

*Important teaching behaviors for effective middle school teaching as identified by authors and researchers*

<table>
<thead>
<tr>
<th>Positive</th>
<th>Johnston and Markle</th>
<th>Buckner and Bickel</th>
<th>Tobin and Fraser</th>
</tr>
</thead>
<tbody>
<tr>
<td>self-concept</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>warmth</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>enthusiastic</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>flexible</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>spontaneous</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>accept students</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>developmentally</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>aware</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>subject knowledge</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>vary instruction</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>structure instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>monitor learning</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>use concrete methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>varied questions</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>indirect teaching</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>positive behaviors</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>individual needs</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>listens</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>friendly</td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>optimistic</td>
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<td></td>
<td>X</td>
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<tr>
<td>humorous</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>fair in grading</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>easy to understand</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>organized for class</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>available to students</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>sustained student engagement</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>increase science</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>understanding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>student activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>participation</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>good learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>environment</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
groups. Findings such as these indicate that while preservice teachers may be schooled in middle school theory they may not be successfully making the transition to application of that theory.

Sparapani, Abel, Edwards, and Herbster (1991) found mixed results regarding teachers' understanding of transescents and their development. They found that middle school teachers often correctly identified one need of transescents while totally ignoring a related need. For example, Sparapani, et al. note that while the surveyed teachers indicated that students received opportunities for cooperative activities generally the teachers did not furnish chances for students to learn social skills appropriate for cooperative learning situations.

State requirements may affect how teachers perceive certification requirements. Georgia was the only state in the country that had a specific middle school certification; teachers from Georgia were the only ones surveyed (Sparapani et al., 1991) who believed that middle level teachers should have specific middle level certification rather than either elementary or secondary certification. The survey indicated the possibility that many middle school science teachers may not be teaching at the preferred
level. Surveyed middle level teachers generally agreed that they would rather be teaching at the elementary level or high school level than at the middle level.

Drawing from several sources Blosser (1986) identified a number of teacher skills considered important for middle school teachers that should be part of a preservice teacher program. However, she then pointed out that teacher preparation schools do not want to provide preservice programs specifically for middle school teaching because middle school certification is not required. States on the other hand do not want to require middle school certification when programs are not in place to provide that certification so no changes are made in middle school certification.

Mechling (1982) surveyed colleges and universities regarding their preservice programs for elementary, middle school, and junior high science teachers. Of the 45 schools that responded 29% said they offered preparation programs specifically aimed at the middle level. The average science requirement at these schools was 30 semester hours. He found that with the broad range of grade organizations (grades 4-9) in middle schools there was a tendency for teachers in the upper levels to complete secondary science
requirements. Conversely, teachers preparing for the lower levels tended to complete elementary requirements.

Mechling also looked at junior high programs. He found that of the 45 schools responding to the survey one-third offered preparatory programs specifically for future junior high science teachers. Over one-half of the schools not offering specific junior high programs included preservice junior high science teachers in the secondary science preparation program. The average science requirement of junior high preservice programs was 38 semester hours with preservice junior high teachers in secondary programs having 42 semester hours. He noted that only five percent of responding schools required a science methods course specifically for the junior high level. Almost 70% of the schools required a secondary science methods course.

Looking at preparation of science teachers Weiss (1987) noted that 85% of elementary teachers in her sample had at least one college biology course, but only 33% percent had one or more chemistry courses, and 20% had at least one college physics course. Weiss notes that National Science Teachers Association (NSTA) recommendations for elementary teachers include at least one course each in biological, physical, and
earth/space sciences. Only 2% of the elementary teachers had a degree in any science. Forty-nine percent of science teachers in grades 7-9 held science degrees and 60% of teachers in grades 10-12 held science degrees.

The Carnegie Report, *Turning Points* (1989), recommends that "Above all else, prospective middle grade teachers need to understand adolescent development through courses and direct experience in middle grade schools." The report also recommends that teachers work as a team within a team framework to design and teach in a way that is developmentally appropriate for the students. Also suggested by the Carnegie Group is that undergraduate education of future middle level teachers should include a solid knowledge core in one or more subject areas. Another suggestion is the use of a paid apprenticeship period for future middle level teachers.

Using data from "Education in the Middle Grades: A National Survey of Practices and Trends", a survey by the Johns Hopkins University Center for Research on Elementary and Middle Schools, McPartland (1990) examined current staffing practices at the middle level. He found that middle level teachers are primarily certified by subject with secondary certification. This occurs where schools tend to have
a high degree of departmentalization with students having a number of teachers during the course of the day. Additionally, he found that there is a tendency for lower levels of the middle grades to have fewer teachers during the course of the day. Generally, younger middle level students have a greater likelihood of being in a self-contained, or nearly self-contained classroom.

McPartland stated that teachers from an elementary certification background tend to demonstrate a "student-centered" orientation and work well in a self-contained or semi-departmentalized setting. He mentions that teachers from a secondary certification background are likely to have a "subject-centered" orientation and may be the best choice for high quality subject instruction at the middle level.

Teacher Preparation

Teacher preparation programs from The Ohio State University, Kent State University, University of Akron, and Capital University were examined for examples of differences between elementary and secondary science preparatory programs. These institutions all have teacher training programs.
Information was collected from certification requirement forms from each school and telephoning education departments when clarification was needed. The elementary certification program at The Ohio State University for Autumn 1991 indicated that future elementary teachers were required to take fifteen quarter hours of Natural Science. These included biology, physics, and earth science. Two of these courses were required to be lab courses. This program required five hours of psychology as well. The secondary science program at The Ohio State University leading to certification in general science required 85 quarter hours of science in several of the science areas.

The elementary certification program at the University of Akron required six semester hours of natural science with an additional twenty semester hours in an area of concentration. The area of concentration could be science or another subject area. The program for general science required a basic six hours of science and an additional 44 hours of science. Both elementary and secondary science preservice teachers were required to take a course on the characteristics of learners.

Future elementary teachers at Kent State University were required to take nine semester hours
of science and an additional twenty or twenty-one hours in an area of concentration which could be science. Three hours of psychology were required for both elementary and secondary science teachers. Future secondary science teachers were required to take 32 semester hours of science in several science areas to receive a minor for general science. The major might or might not be in one of the science areas.

Capital University, a private school in Columbus, Ohio, required eight semester hours of biology and physics for prospective elementary teachers. No mention was made of a subject area of concentration unlike the three state supported schools. Capital University required six hours of psychology for elementary teachers and three hours for secondary science teachers. Future secondary science teachers seeking general science certification were required to take a natural science class and an additional 30 hours covering biological, physical, and earth sciences.

Teacher preparation programs such as these show a great deal of variation in requirements for future teachers (Table 4). One area where different programs may impact the classroom is the classroom environment.
Table 4

Hours of science required in elementary and secondary science certification programs in selected universities

<table>
<thead>
<tr>
<th></th>
<th>Elementary Hours</th>
<th>Secondary Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>science</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>science methods</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Kent State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>science</td>
<td>9</td>
<td>32&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>science methods</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>The Ohio State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>science</td>
<td>10</td>
<td>57</td>
</tr>
<tr>
<td>science methods</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>University of Akron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>science</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>science methods</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

<sup>1</sup>Note. All credits are in semester hours
<sup>a</sup>Offered only as a minor

My Class Inventory (MCI)

The My Class Inventory is a five-item Likert type instrument designed to measure classroom environment as perceived by upper elementary/middle level students. The version of the MCI used in this study was described by Fisher and Fraser in 1981.
Anderson (1971 as cited in Fisher & Fraser, 1981) developed the My Class Inventory (MCI) as a simplified form of the Learning Environment Inventory (Walberg, 1968 as cited in Fisher & Fraser, 1981) for use with younger students. Modifications to the Learning Environment Inventory (LEI) included reduction of the original fifteen scales to five scales, easier readability for younger students, and altering 4-point responses to forced choice responses. Fisher & Fraser (1981) later modified the MCI to improve reliability.

Fraser & Fisher (1982a) used the MCI to investigate the relationship of learning environment to two cognitive outcomes and one affective outcome. They found a statistically significant relationship between student learning outcomes and student perceptions of the classroom environment. Fraser & Fisher (1982b) used five different analyses to confirm a significant relationship between classroom environment perceptions as measured by the MCI and learning outcomes.

Fraser & O'Brien (1985) used a shortened 25 item MCI (Fraser, 1982) to investigate elementary student and elementary teacher perceptions of their preferred and actual classroom learning environment. The results of their version of the MCI indicated that both students and teachers prefer a more favorable
environment than either perceives as actually present. Teacher scores on perceived classroom environment were higher than student scores on the same scale indicating that teacher perceptions of the learning environment were more favorable than student perceptions.

Fuqua (1989) used the short version of the MCI to measure student perceptions of the learning environment with the goal of helping the teacher improve the classroom environment. Using the MCI, Fuqua was able to delineate specific attributes of the class as well as specific areas for improvement.

Lawrenz (1987) used the MCI with elementary and junior high students in a study of perceived classroom environment based on the gender of the teacher and the gender of the student. Lawrenz used the Learning Environment Inventory (LEI) for high school students. In this study Lawrenz found no significant difference of student perception of the learning environment for male or female teachers at the fourth grade level, although increasing differences existed from seventh grade through high school. In the fourth and seventh grades perceptions were independent of student gender.

Knight, Owens, and Waxman (1991) used a modified version of the MCI to look at learning environments of traditionally certified teachers compared to teachers
with alternative certification. Several of the scales indicated that traditionally certified teachers had more favorable learning environments on several of the scales. Knight et al. caution that care should be used with this information since other, unmeasured characteristics may also exist.

Science Attitude

Haladyna, Olsen, and Shaughnessy (1982) looked at student, teacher, and learning environment as exogenous contributors to science attitude in fourth, seventh, and ninth grade students. They found that relationships between these variables and science attitude strengthened as students progressed to higher grades. Student perception of the quality of the teacher was the strongest correlation involving teacher variables. Learning environment variables showing moderate correlation with attitude included satisfaction, enjoyment of classmates, class environment, organization, and attentiveness. They found that a number of other learning environment variables they expected to impact on attitude showed little influence.

Fraser and Butts (1982) looking at the effect of student perception of class individualization on science attitude found that greater perceived
individualization correlated with more positive attitudes toward junior high science. Fraser and Fisher (1983) looking at more than 2,000 junior high students found that while classroom openness was related to attitude it was not related to cognitive achievement.

Talton and Simpson, (1985) looked at correlations of individual attitudes with attitudes of the peer group. They were concerned with students in grades 6 through 10. Generally they noted a trend for associations to become greater as the school year progresses. This occurred to the extent that by the end of the year correlations were nearly identical across the five studied grades regardless of the level of relationship at the beginning of the year. Additionally, they found that association between individual and peer group attitudes strengthens as students progress from sixth grade through seventh and eighth grades. This correlation peaks in ninth grade and falls off with students in the tenth grade.

The relationship of family to science attitude in ability grouped seventh and tenth grade students was investigated by Bridgeman, Oliver, and Simpson, (1985). In this study they found that the variable they labeled "family science" was significantly and consistently related to science attitude. Family
science was defined as student perception of the family's support for science. Other correlations were noted by tracks, particularly Track 3 with attitude and selected variables; however no definition was given for the level of each track. Because of this it is difficult to find meaning in the other results.

Cannon and Simpson (1985) measured science attitudes with ability among seventh grade life science students. Measurements were made three times during the year. Student gender was noted as an additional variable. Results indicated that science attitude declined in all groups and both genders during the course of the school year. They found in all ability groups that while male students had more positive attitudes than female students the difference was not statistically significant. Advanced track male students had the most positive attitudes toward science.

Baker (1985) looked at the value of attitude, cognitive ability, and personality as predictors of science achievement at the middle school level. Females in the study tended to have a better attitude toward science than males as well as better science grades. Subjects with the most positive attitudes toward science tended to be more intuitive and introverted than subjects with more negative
attitudes. However, students with more negative attitudes toward science possessed a higher degree of spatial ability and had better grades than the group with more positive attitudes.

In a study of 228 sixth grade students Harty and Samuel (1986) found that differences between male and female student scores on an attitude scale were not statistically significant. Other findings indicated that attitude toward science was positively correlated with interest in science, curiosity, and self-concept of science ability.

Barrington and Hendricks (1988) studied 143 average and gifted students in third, seventh, and eleventh grades. They found that science attitude dropped strongly between third and seventh grades, but rebounded by eleventh grade, particularly with gifted students. Looking at subscales suggested that most of this change could be ascribed to science class and science teacher components. They found that attitudes toward science classes of gifted students in the eleventh grade were much better than average students.

In their 1983 meta-analysis that investigated a number of student characteristics, grades kindergarten through twelve, Fleming and Malone (1983) noted a correlation between attitude and general ability. The correlation was approximately one third that of four
other measured factors (3 types of cognitive measures and science achievement). They noted a small correlation between socioeconomic status and science attitude. This was similar to the small correlation noted between gender and science attitude. When data were considered by race, Anglo elementary students' attitude scores were more favorable than Blacks'. By the time students were in high school the scores changed to the point that black students began to have better attitude scores than white students. It was noted that differences in attitude scores were smaller when white students are compared with Hispanic students.

In his 1983 meta-analysis Wilson (1983) found that junior high males showed a more favorable science attitude than female students, however this difference was not statistically significant. Correlations found at the junior high level were similar to correlations at the elementary level. Wilson found that nation was a significant factor, however this result may not be valid because of different types of attitude scales used in different locations.

Steinkamp and Maehr (1983) found that junior high males had more positive attitudes in science than did females. They found that correlations of achievement with cognitive ability were significantly positive for
both male and female students. This pattern was consistent across all grade levels. Correlations of achievement with affect were small, but greater than zero for both male and female students. The relationship between cognitive ability and affect was not strong for either male or female students.

**Summary**

Several studies have mentioned teaching behaviors or clusters of behaviors that typify exemplary middle level teaching. Lists of these behaviors can be found in Table 1 and Table 2. Generally these behaviors exhibit a considerable commonality with behaviors identified as good teaching behaviors at all levels.

The literature suggests that preparation for middle level teaching may not be particularly well done. Discrepancies sometimes appear between practices learned in preservice preparation and later classroom applications of those practices by teachers. Change in teacher certification for the middle level, and therefore, preparation for the middle level may be difficult to bring about. It was suggested that schools appear reluctant to offer courses not required by state certification agencies and states may be
hesitant to require programs not offered at teacher preparation institutions.

Generally, preparation in the sciences is more complete and thorough for teachers certified through secondary science programs than through elementary certification programs. This may be particularly true in the physical sciences. There appears to be a slight tendency for elementary certified teachers to take more psychology courses than secondary science teachers. Currently middle level schools tend to be staffed by slightly more secondary certified personnel than elementary certified personnel. A common observation among teachers is that elementary teachers are more student-oriented while secondary certified teachers are more subject-oriented. This was suggested by McPartland (1990).

While a number of studies have been done at the middle level on science attitude, particularly in areas of gender differences, the results indicate that males may have a slightly better attitude toward science than female students. A tendency for science attitude to decline with increase in grade at the middle level was noted.
Chapter III

Methods and Procedures

Design:

The study was ex-post facto research using a mixture of quantitative and qualitative methods. Combining research techniques from the two paradigms allowed greater depth and breadth than using either separately. The quantitative portion occurred early in the study and consisted of administering two instruments to students of participating teachers. One instrument, the My Class Inventory, was designed to measure the learning environment in classrooms. The second instrument was designed to measure student attitudes toward different aspects of science. Information from this section of the study was used in two ways: first to look at differences in classroom environments and second to triangulate data from other phases of the study.

Qualitative data collection consisted of
classroom observations of teacher behaviors and classroom activities and interviews with participating teachers. Additional qualitative data included interviews with administrators of participating teachers.

The Population

The study population consisted of middle school science teachers selected from school districts participating in a science curriculum enhancement project. This Eisenhower Grant funded project had as its goal the improvement of middle school science through curricular change and expanded knowledge of subject matter and middle level issues. Teachers participating in the project received training in areas such as curricular development, global education, and cooperative learning. Considering their additional training in issues relevant to middle level education it seems likely that these teachers would vary from typical middle level teachers.

Teachers were selected from three districts. Participating teachers were purposefully selected to have teachers from both an elementary and a secondary preparatory background. Five teachers from each preparatory background were used for gathering information. Teacher participation in the project was voluntary.
The ten participating teachers had an average of nearly 16 years of total teaching experience with a range of five to 31 years. They averaged just over thirteen years at the middle level with a range of four to twenty-five years. Breaking this down by certification type elementary certified teachers participating in the study averaged close to fourteen years (13.7) of teaching experience with a range of five to thirty-one years and almost eight years (7.9 years) at the middle level with a range of four to twelve years. Secondary science certified teachers averaged just over eighteen years (18.2) of teaching experience ranging from seven to twenty-five years. The secondary certified teachers had taught only at the middle level so middle level experience is the same as general teaching experience.

The Study

The study occurred in three phases. The first consisted of administration of the My Class Inventory (MCI) and an attitude scale to science classes of each participating teacher. The two instruments were completed early in the study. Two teachers were able to administer the instrument to all but one science class. All other participating teachers administered the instruments to all science classes. Teachers
administered the instrument in their own classroom at their convenience to minimize disruption to the class. Instruments were collected by the investigator at a later time. Visual observation of student answer forms during data coding gave no suggestion of data alteration.

The second phase of the study consisted of interviews with the ten participating middle school science teachers. Attempts were made to complete interviews early in the study, soon after the administration of the MCI. However, scheduling problems forced interspersing of interviews with administration of the instruments. Often interviews occurred after administration of the instruments.

The interviews used the general interview guide approach described by Patton (1990). This approach relies on a scripted discourse consisting of questions or issues to be explored during the course of the discussion. This allows freedom to explore issues, but with a predetermined focus. Patton mentions that this approach allows continuity of interviews with multiple subjects. The interview guide for participating teachers may be found in Appendix A and that for participating administrators in Appendix B. This phase focused on teacher perceptions of preservice preparation, changes in teaching behaviors
with experience, influence of additional course work, and perceptions of desirable traits for teaching middle school science. Meetings with principals of participating teachers were conducted for additional information and perceptions of middle school teachers.

Finally, the third phase of the study consisted of classroom observations by the investigator. Observations were made in the classrooms of participating middle school science teachers. Observations occurred after interviews with participating teachers in most instances. The focus of classroom observations was middle school teacher characteristics identified by both Johnston and Markle (1986) in Table 2 (page 22) and Buckner and Bickel (1991) in Table 1 (page 20) as desirable. The investigator used an observation sheet (Appendix C) containing specified characteristics derived from Buckner and Bickel to facilitate observations. Interrater reliability was established with a doctoral student who was well versed in qualitative research methods rating identified teacher behaviors at the same time in the same classroom as the researcher. Examination of the two ratings afterward indicated that no problem existed with assigning of the ratings. A given behavior was considered to exist when it stood out from the normal flow of the class. During most
observation periods normal class flow would be as a
discussion or a work period with few behaviors
actually in evidence. Behaviors were usually easy to
identify.

Instrumentation:
The quantitative phase of this study used a
modified version of My Class Inventory (MCI) described
by Fisher & Fraser (1981) to collect information about
classroom learning environments. The MCI (Appendix D)
contains five scales; Cohesiveness, Friction,
Difficulty, Satisfaction, and Competitiveness. Fisher
and Fraser tested the instrument on a group consisting
of 2,305 seventh grade students in 100 classrooms in
Tasmania, Australia. They administered the MCI toward
the end of the school year. In this test Fisher and
Fraser found that the five MCI scales showed
satisfactory discriminant validity, internal
consistency, and predictive validity. Additionally,
each scale was able to differentiate significantly
between perceptions of students in different
classrooms.

The instrument was tested in a pilot study
(n=117) in the spring of 1991 with a student
population similar to the student population to be
tested in this study. Alpha reliabilities from Fisher
and Fraser (1981), from the pilot test, and this study from Spring 1992 (n= 1027) show close agreement (Table 5).

**Table 5**

*Alpha reliabilities of MCI as reported by Fisher and Fraser (1981), from the pilot study of Spring 1991, and this study Spring 1992*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Fisher &amp; Fraser</th>
<th>Pilot Test</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesiveness</td>
<td>.63</td>
<td>.64</td>
<td>.68</td>
</tr>
<tr>
<td>Friction</td>
<td>.68</td>
<td>.69</td>
<td>.65</td>
</tr>
<tr>
<td>Difficulty</td>
<td>.68</td>
<td>.78</td>
<td>.60</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>.76</td>
<td>.75</td>
<td>.78</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>.72</td>
<td>.68</td>
<td>.54</td>
</tr>
</tbody>
</table>

Students responded on a separate answer sheet (Appendix D). Although the answer sheet also requests limited personal information about the student, there was no student identification. Additionally, scale for each question was indicated on the answer sheet. Questions in the Cohesiveness scale were indicated by CH, the Friction scale by F, the Difficulty scale by D, the Satisfaction Scale by S, and the
Competitiveness scale by CM.

The instrument produced similar reliabilities each time it was administered with the exception of scores on two scales for this study. Reliability scores for the Difficulty scale and the Competitiveness scale were somewhat lower than those observed by Fisher and Fraser and on the pilot study. Accordingly, care should be taken before assigning too much meaning to results on these two scales.

Development of the Attitude Instrument

A need was felt for a recently developed attitude instrument targeted specifically at the middle level. A review of existing instruments of recent vintage failed to produce one that was satisfactory for this study. Therefore, an attitude instrument was developed to fill this need. It was developed as a five-point Likert-type scale using four questions from School Science Attitudes developed by Dr. Steven Oliver and borrowing concepts from the Test of Science Related Attitudes (Fraser, 1981). Questions one, two, nine, and eleven were taken from School Science Attitudes. All other questions were related to concepts borrowed from the Test of Science Related Attitudes. Questions were written by the researcher in conjunction with the dissertation advisor. Initial
labeling of scales was for identification of concepts that were intended to be measured. Initially the instrument was designed with two eight-item scales, one to measure attitude toward science class and a second to measure attitude toward science. Later four questions were added to measure student attitude toward science as an interdisciplinary subject and science as a cooperative endeavor (Appendix E).

The instrument was administered to students as described previously. Factor analysis indicated that the instrument was measuring three constructs (Table 6). A factor correlation matrix was run on data as well (Appendix F). Based on the nature of the questions, the constructs were identified as: attitude toward science class, value of science, and attitude toward science in society. Generally the questions grouped into scales as anticipated. However, two questions (Items ATT11 and ATT13) that were placed in the attitude toward science scale actually grouped with the attitude toward science class. Questions evaluated as fitting into attitude toward science grouped together. The four additional questions grouped with the scale initially labeled attitude toward science and relabeled value of science. Additionally ATT12 and ATT10 grouped separately in a scale labeled attitude toward science in society.
Factor loading information was used to calculate reliabilities for the three scales (Table 7).

Table 6

*Factor loadings for the attitude instrument by scale.*

**Factor 1 - attitude toward science class**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT1</td>
<td>Science is a subject that I like.</td>
<td>.88065</td>
</tr>
<tr>
<td>ATT5</td>
<td>I look forward to science class almost every day.</td>
<td>.86756</td>
</tr>
<tr>
<td>ATT3</td>
<td>I find science class boring.</td>
<td>.82243</td>
</tr>
<tr>
<td>ATT2</td>
<td>Taking more science classes is an enjoyable idea.</td>
<td>.81478</td>
</tr>
<tr>
<td>ATT6</td>
<td>I think science class is interesting.</td>
<td>.79298</td>
</tr>
<tr>
<td>ATT7</td>
<td>I hate going to science class.</td>
<td>.73528</td>
</tr>
<tr>
<td>ATT13</td>
<td>Science is useless for me.</td>
<td>.62640</td>
</tr>
<tr>
<td>ATT4</td>
<td>In the future I plan on taking as little science as possible.</td>
<td>.54172</td>
</tr>
<tr>
<td>ATT11</td>
<td>Everyone should know about science.</td>
<td>.53716</td>
</tr>
<tr>
<td>ATT6</td>
<td>Science activities are not interesting.</td>
<td>.52706</td>
</tr>
</tbody>
</table>

**Factor 2 - value of science**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT20</td>
<td>Science is best studied by myself, not by working with others.</td>
<td>.67242</td>
</tr>
<tr>
<td>ATT16</td>
<td>It is useless for people to know about science.</td>
<td>.61490</td>
</tr>
<tr>
<td>ATT19</td>
<td>I like to study a problem using many subjects including science.</td>
<td>.61265</td>
</tr>
<tr>
<td>ATT17</td>
<td>Studying science does not involve other subjects.</td>
<td>.59125</td>
</tr>
<tr>
<td>ATT14</td>
<td>Scientific discoveries have caused more problems than they have solved.</td>
<td>.54720</td>
</tr>
<tr>
<td>ATT15</td>
<td>I believe science will make our lives better in the future.</td>
<td>.54313</td>
</tr>
<tr>
<td>ATT18</td>
<td>Science is best studied by working with others.</td>
<td>.46907</td>
</tr>
<tr>
<td>ATT9</td>
<td>I want to continue learning about science and technology.</td>
<td>.44179</td>
</tr>
</tbody>
</table>

**Factor 3 - attitude toward science in society**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT12</td>
<td>Scientific discoveries make our lives better.</td>
<td>.84053</td>
</tr>
<tr>
<td>ATT10</td>
<td>We do not need to know any science to get along today.</td>
<td>.52132</td>
</tr>
</tbody>
</table>
Table 7

**Alpha Reliabilities from Attitude toward science class, Attitude toward science, and Attitude toward science as a cooperative endeavor scales.**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward science class</td>
<td>.92</td>
</tr>
<tr>
<td>Value of science</td>
<td>.81</td>
</tr>
<tr>
<td>Attitude toward science in society</td>
<td>.60</td>
</tr>
</tbody>
</table>

**Qualitative Data**

The qualitative phase of this study consisted of teacher interviews and classroom observations. The interviews were computed during the course of the study subject to the availability of teachers. Interviews used the general interview guide approach described in this paper in the section describing procedures as well as by Patton (1990). Each participating teacher was interviewed once. Issues explored during the interview were selected prior to the interview. Issues to be explored generally fell into the categories of perceptions of preservice preparation, changes in teaching behaviors with experience, influence of additional course work, and
perceptions of desirable traits for teaching middle school science. A listing of issues for the interview is located in Appendix A. It was anticipated that the interview would take one half-hour or less. In practice, two interviews were not completed during a thirty-minute taping session. One interview lasted one or two minutes longer and the other interview lasted about forty minutes. Most of the interviews were completed in twenty to thirty minutes. Each was tape-recorded with permission of the interviewee. Attempts were made to hold all interviews in an area where few interruptions and distractions would occur and where the interviewee felt comfortable. Most interviews were held in the teacher's classroom before school, after school, or during a free period. Tapes were transcribed later for better access to interview information. Each teacher was able to review a transcript of his or her interview to verify the accuracy or accuracy of opinions. Changes were minor consisting of minor wording changes without alteration of meaning.

The classroom observation phase of the study was the most time consuming. Classroom observations began as soon as teachers participating in the study were identified. Observations focused on observable teacher characteristics. The investigation targeted
how these characteristics were manifested in different teachers in the classroom environment as they interact with students in the classroom. The way teachers used different teaching characteristics identified by Buckner and Bickel (1991) was used to characterize each teacher’s instructional style. Written notes were used to document events in classrooms. Observations were made with full knowledge of the participating teacher. The observer attempted to remain unobtrusive to minimize class disruptions and alteration of behaviors on the part of both student and teacher.

Analysis:

Data from the MCI were analyzed by class, and by teacher certification to allow comparison of teachers from elementary preservice backgrounds with teachers from a secondary preservice background. This comparison utilized a t-test with a significance level of alpha equal 0.05. Analysis of variance (ANOVA) was used to identify significant differences in all teachers for each MCI scale.

Content analysis was used to look for consistent themes in both the interview data and the observational data. This allowed searching for consistent patterns of behaviors and responses with data from both sources. Data from transcripts of
interviews and field observations were coded into a Filemaker II data base program for analysis. Coding of data consisted of replacing phrases and paragraphs with one or more summative, descriptive words to allow rapid identification of patterns using the database program. Coding was checked for consistency by another student specializing in qualitative research. Patterns of data relevant to the preservice background of each teacher were of primary interest. Teaching characteristics that may relate to type of certification were of particular interest. The open-ended nature of the qualitative approach dictated that detailed methods of data analysis developed as the data were collected.

**Procedures:**

The study began in early May, 1992 with administration of the MCI and the attitude scale to classes of a purposefully selected sample of middle school science teachers. Each teacher administered the MCI and attitude scale to her/his own classes. The answer forms were confidential and anonymous without names or any type of identifying codes. The MCI forms were scored by the researcher and results entered for computer analysis by either SPSSx or Minitab.
The sample of science teachers was selected such that one-half were from a secondary preservice background and one half were from an elementary preservice background. Each teacher was interviewed once using the general interview guide approach. Using this approach the interviewer works with guidelines of topics to be covered however the format "allows individual perspectives and experiences to emerge." (Patton 1991). Topics used in the interview portion of the study were primarily related to preservice background, middle school teaching, and changes in teaching style through time.

Classroom observations began at this time. The observer visited at least one class belonging to each teacher once a week from the time each participating teacher was identified until the end of the school year. Additional information on observations can be found in Table 18 (page 130). The purpose of observations was to observe teaching characteristics that are relevant to middle school teaching. A listing of characteristics suggested in the literature (Table 1, page 20 and Table 2, page 22) was used as a starting point for coding observations (Johnston and Markle 1986, Buckner and Bickel 1991). A secondary purpose of observations was to observe student responses to teacher characteristics. This may help
determine teaching characteristics that appear to be especially valuable in teaching middle school.

Different aspects of the research were designed to address the research questions. A quick overview of the research question, the portion of the study methodology that addresses the question and the expected results follows.

**Problem 1:** How do middle school science teachers perceive their preservice background both in science and in pedagogical techniques?

*Sub Problem A:* Will teachers from a nonscience background perceive their science background as adequate for teaching middle school science?

*Sub Problem B:* Will teachers from different preservice backgrounds perceive teaching differences between the two preparatory backgrounds?

Both Sub Problem A and Sub Problem B were addressed by interview data from participating teachers.

Sub Problem A: It was anticipated that elementary prepared teachers would perceive a need for greater science content in their preparation and that secondary science certified teachers would be
generally satisfied with their science preparation. Sub Problem B: Prior to the study the expected result was that both certification types would perceive that elementary preparation was more child oriented and secondary science preparation was more subject oriented.

**Problem 2:** Will student perception of the learning environment be related to the preparatory background of the teacher? This question was addressed by the quantitative portion of the study. Student perceptions of the classroom environment were measured using The My Class Inventory. It was expected that the difficulty scales would indicate that secondary prepared teachers were perceived as having more difficult classes. There were no expectations for the other scales.

**Problem 3:** What teaching characteristics do middle school science teachers rate as the most effective in creating a positive learning environment? Interview data from teacher interviews was used to answer this question. It was anticipated that subject knowledge would rate as particularly important, especially among secondary science certified teachers.

**Problem 4:** What differences in teaching behaviors
exist between teachers with elementary and teachers with secondary preservice preparation?

Sub Problem A: What is the relationship between teaching behaviors and preservice background?

Sub Problem B: Are differences in teaching behaviors perceived to diminish with time?

Sub Problem A was investigated using information from classroom observations. Information relating to Sub Problem B was taken using data from interviews with participating teachers.

The expectation was that secondary certified teachers would have strong subject orientated behaviors while teaching. Elementary certified teachers were expected to exhibit more of a child orientation. When looking at Sub Problem B the expectation was that teachers would perceive differences to diminish with time.
Chapter IV

Results

The middle level teacher characteristics described by Buckner and Bickel (1991) guided the design of the qualitative portion of the study. Interview questions and classroom observation schedules were designed from information contained in that study. Teacher interview forms (Appendix C) included variables mentioned by Buckner and Bickel as well as related information. Additional questions attempted to investigate the motivation for becoming a teacher and selection of teaching level as well as perceived teacher/student relationships.

Teacher data were coded by number, one through five for each certification type. Code numbers were randomly assigned to each teacher. A prefix letter indicates the certification type, an E indicating elementary certification and an S indicating secondary science certification. Descriptions of participating teachers may be found in the next section of this chapter.

Profiles of participating teachers and
administrators are presented first in Chapter 4. This should provide some familiarity with participating teachers and administrators as data pertaining to them are examined. Following the descriptions of participating teachers and administrators is the data from interviews with participating teachers and administrators. Qualitative data from classroom observations are in the third section of this chapter followed by quantitative data from students in the classrooms of participating teachers.

Participating School District Profiles

School District MS 1

The school district MS 1 is located in a rapidly growing suburban area outside a large midwestern city. The school district is characterized by farms and new housing subdivisions along with areas of small towns. The district is represented by diverse socioeconomic groups. While the majority of students are white, a significant minority population is present. The school itself is in an area mixed with farms and new housing developments.
School District MS 2
School District MS 2 is located in a moderately sized town away from any large urban areas. The immediate area, while experiencing population growth, is still characterized by large areas of farmland. The student population is characterized by very low minority representation. The school itself is located in town. The town is residential. Local industries are located out of town.

School District MS 3
School District MS 3 is suburban with little open area. The community is surrounded by other municipalities and as a result has a relatively stable population. Socioeconomically the district is largely middle to upper middle class. The district is characterized by low racial diversity. The school is located in an area typical of the community with housing around the school and little commercial development in the immediate area.

Participating Teacher Profiles

Teacher El
Teacher El taught earth science, life science, physical science, and health at the seventh grade
level at the time of the study. Her experience includes teaching at the middle level for four years and at the secondary level for one year. Additionally, teacher E1 had substitute taught part-time for three years. The year of secondary teaching was prior to teaching at the middle level. This teacher was unique in the study in that both elementary and secondary certification were held. However, the area of secondary certification in speech communication and theater was totally unrelated to any science content area. The teacher held a Bachelors Degree and had taken three quarter hours of science since receiving that degree. Her initial secondary certification came through an education program in an adjoining state in 1986. She met state department criteria to receive elementary certification in Ohio in 1989. She taught at School District MS 1.

Teacher E2

Teacher E2 taught life science, environmental science, earth science, and general science at the sixth and seventh grade levels. He held a Bachelor's Degree in Elementary Education with a minor in coaching. His certification was through a teacher training program at an Ohio university with initial certification being granted in 1981. All of his ten
and a half years of teaching experience was at the middle level. Additionally, six quarter hours of science had been taken since receiving the Bachelor’s Degree. Teacher E2 had received a Master’s Degree. He taught at School District MS 2.

**Teacher E3**

Teacher E3 taught earth science, life science, physical science, and health at the sixth grade level. His teaching experience included three years at the elementary level followed by seven years at the middle level. Teacher E3 held a Bachelor’s Degree in Early and Middle Childhood Education with certification coming through an Ohio university in 1982. Six quarter hours of science had been taken since receiving the Bachelor’s Degree. Teacher E3 had received a Master’s Degree prior to the study. He taught at School District MS 1.

**Teacher E4**

Teacher E4 taught life science, physical science, and earth science at the sixth grade level. Her teaching experience included ten years at the elementary level as a Learning Disability Tutor followed by twelve years as a full time middle school teacher. Teacher E4 had a Bachelor’s degree in
Elementary Education with a minor in science. Her certification came through a university program with the initial certificate being granted in 1969. The teacher reported taking "many science workshops" since receiving the Bachelor's Degree. She taught at School District MS 1.

**Teacher E5**

Teacher E5 taught general science at the sixth grade level at the time of the study. Her teaching experience included twenty-five years at the elementary level, teaching grades one through eight, and six years at the middle level. Teacher E5 had a Bachelor's Degree majoring in Education and had taken 18 quarter hours of science beyond the Bachelor's Degree. Her initial certification was granted in 1956. She had received a Master's Degree at some time prior to the beginning of the study. She taught at School District MS 2.

**Teacher S1**

Teacher S1 taught life science at the seventh grade level at the time of the study. Career teaching experience was entirely at the middle level for twenty-five years. Teacher S1 received a Bachelor's Degree with a major in Social Studies and a minor in
Science. She had taken approximately eighty quarter hours of science beyond the Bachelor's level. Additionally, she held a Master's Degree. Her certification came through the education program at the university. Initial certification was in 1959. She taught at School District MS 3.

**Teacher S2**

Teacher S2 taught life science at the seventh grade level during the study. She held a Bachelor's Degree in Secondary Education with a major in Biological Sciences and a minor in Athletic Training. Her certification came through the education program of her university. Her initial certification was in 1985. She had taught for seven years with all seven years being at the middle level. She had taken seven quarter hours of science beyond the Bachelor's Degree. She taught at School District MS 2.

**Teacher S3**

Teacher S3 taught earth science at the eighth grade level at the time of the study. Teaching experience consisted of nineteen years of teaching at the middle level. He received a Bachelor's Degree with a major in history and a minor in Earth Science. His certification was granted through the certification
program at his university in 1971. Additional hours included eighty post-Bachelor's Degree hours in Science. Teacher S3 had a Master's Degree as well. He taught at School District MS 2.

**Teacher S4**

Teacher S4 taught life science and earth science at the seventh and eighth grade levels. His teaching experience consisted of twenty-four years teaching at the middle level. All of his experience was at the middle level. He received a Bachelor’s Degree with a major in Comprehensive Science. His certification was through the education program at his university with initial certification being granted in 1967. He had taken one hundred and fifty hours of science beyond the Bachelor's Degree level. Additionally, teacher S4 had a Master’s Degree. He taught in School District MS 3.

**Teacher S5**

Teacher S5 taught biological science and earth science at the eighth grade level at the time of the study. He had taught for sixteen years at the middle level and had no teaching experience outside of the middle level. He had a Bachelor’s Degree with a major in Science and a minor in General Science. His
certification was through the education program of his university with initial certification being granted in 1976. He had taken thirty quarter hours of science beyond the Bachelor's Degree Level. Additionally, he had a Master's Degree. Teacher S5 taught at School District MS 2.

Information from the administrators of participating middle schools was collected to frame the environment of the study rather than address the specific problems being investigated. These data include interviews and administrator profiles.

**Participating Administrator Profiles**

**Administrator A1**

Administrator A1 had taught for four years before becoming an administrator. His teaching experience consisted of two years at the elementary level and two years at the middle level. At the time of the study he had been an administrator for eleven years. All eleven years were at the middle level. He held elementary certification as a teacher. He majored in Speech and minored in Russian for his Bachelor's Degree. He held a Master's Degree at the time of this study. Administrator A1 was a principal in School District MS 1.
Administrator A2

Administrator A2 had taught for five years prior to entering administration. All five years of teaching experience were at the middle level. She had been an administrator for thirteen years at the time of the study. All thirteen years of administration were at the middle level. Her Bachelor's Degree included majors in Elementary Education and Secondary English. She held both elementary and secondary certifications. She held a Master's Degree at the time of the study. Administrator A2 was a principal in School District MS 2.

Administrator A3

Administrator A3 had taught high school science for three years before entering administration. At the time of the study he had been an administrator for twenty-four years. He was a high school administrator for one year. The rest of the time was at the middle level. He held a Master's Degree at the time of the study. Administrator A3 was a principal in School District MS 3.

A summary of characteristics of participating teachers is included in Table 8.
Table 8

*Summary of characteristics of participating teachers.*

<table>
<thead>
<tr>
<th>Teacher</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>A1</td>
<td>A2</td>
<td>A1</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A2</td>
<td>A2</td>
<td>A3</td>
<td>A2</td>
</tr>
<tr>
<td>District</td>
<td>MS1</td>
<td>MS2</td>
<td>MS1</td>
<td>MS1</td>
<td>MS2</td>
<td>MS3</td>
<td>MS2</td>
<td>MS2</td>
<td>MS3</td>
<td>MS2</td>
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<tr>
<td>Gender</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>M</td>
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<tr>
<td>Degree</td>
<td>B</td>
<td>M</td>
<td>M</td>
<td>B</td>
<td>M</td>
<td>B</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Experience</td>
<td>5</td>
<td>10.5</td>
<td>10</td>
<td>12</td>
<td>31</td>
<td>25</td>
<td>7</td>
<td>19</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>MS Experience</td>
<td>4</td>
<td>10.5</td>
<td>7</td>
<td>12</td>
<td>6</td>
<td>25</td>
<td>7</td>
<td>19</td>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>

1 E = elementary certified; S = secondary certified.  
2 Indicates administrator information code  
3 Indicates school district information code  
4 F = Female; M = Male  
5 B = Bachelors Degree, M = Masters Degree.  
6 Years.
Quantitative Data-MCI and Attitude Instrumentation

The classroom environment inventory and the attitude inventory represent data from the classrooms of the ten teachers. A total of 1,026 students completed both inventories. Five hundred eight students were in science classes with teachers who had elementary certification and five hundred eighteen students were in science classes with teachers who had secondary science certification.

Differences in summated Likert means from scales of the My Class Inventory and the science attitude instrument were compared using t-tests. Comparisons between the two certification types were made using separate variance estimates rather than pooled variance estimates, recommended by Norusis (1990) when variances of the two groups being tested are not considered to be identical.

None of the scales showed significant differences (α = .05) between teachers with elementary certification and teachers with secondary science certification (Table 9, page 73). The greatest difference between the two types of certification occurred on the scale for student perception of class difficulty. The two means observed were 11.6 for teachers with elementary certification and 12.5 for
teachers with secondary science certification. However, this difference was not statistically significant at the alpha = .05 level. Observed scores on this study were similar to MCI scores noted by Fisher and Fraser (1981).

Table 9

Comparison of Mean MCI Scale Scores and t-values by Science Teacher Certification Type

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean by Cert&lt;sup&gt;a&lt;/sup&gt;</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ele</td>
<td>SecSci</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>17.7</td>
<td>17.8</td>
<td>-0.04</td>
</tr>
<tr>
<td>Friction</td>
<td>16.0</td>
<td>16.0</td>
<td>0.07</td>
</tr>
<tr>
<td>Difficulty</td>
<td>11.6</td>
<td>12.5</td>
<td>-1.2</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>14.6</td>
<td>14.3</td>
<td>0.73</td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>10.4</td>
<td>10.4</td>
<td>0.09</td>
</tr>
</tbody>
</table>

<sup>a</sup>N = 10.

The data from the attitude instrument like data from the MCI did not indicate significant differences (α=.05) between scale means for the two certification types (Table 10). However, the means for the scale describing attitude toward science in society showed the greatest divergence. The mean for students with
teachers having elementary certification was 31.6 and the mean for teachers holding secondary science certification was 33.1. While this difference in means was the largest observed for either instrument the difference was not statistically significant at the alpha = .05 level.

Table 10

*Comparison of Mean Attitude Scale Scores and t-values by Certification Type of Participating Teachers*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean by Cert</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ele</td>
<td>SecSci</td>
<td></td>
</tr>
<tr>
<td>Att to Sci Class</td>
<td>34.6</td>
<td>35.2</td>
<td>-0.23</td>
</tr>
<tr>
<td>Value of Science</td>
<td>31.6</td>
<td>33.1</td>
<td>-1.45</td>
</tr>
<tr>
<td>Att to Sci in Soc</td>
<td>7.4</td>
<td>7.5</td>
<td>-0.59</td>
</tr>
</tbody>
</table>

aN = 10.

Summations of student responses for each teacher were used for analysis of variance (ANOVA) comparisons for differences between teachers on both the MCI and on the attitude instrument means. The results of the ANOVAs of the MCI and the attitude instrument means are located in Tables 10 through 16. For ease of comparison teachers are designated with “E” for elementary certification and “S” for secondary science.
certification. Within certification types "E" and "S", the numbers "1" through "5" were randomly assigned to each teacher. These codes coincide with teacher descriptions from the first part of this chapter. For purposes of comparison the assigned teacher number is the same for each teacher in Tables 11 through 16 (pages 76-82).

When comparing mean scores on the Satisfaction with Science Class Scale of the MCI (Table 11, page 76) teachers E1, E2 and S2 differed significantly from other teachers of both certification types. Teacher S4 differed as well, but less than teachers E1, E2, and S2. High mean scores on this scale are indicative of greater student satisfaction with the science class of that teacher. Conversely, low mean scores indicate lower student satisfaction with a teacher's science class.

High mean scores on the Friction in Science Class Scale of the MCI (Table 12, page 77) indicate a science class with more friction than classes with lower scores. Mean scores indicate that science students of teacher E5 perceive a great deal of friction in those classes. Teacher E5 differs significantly from every other teacher in the study in this regard. Teacher E1 differs significantly from four of the teachers with a score indicating a low
level of friction in those science classes.

Table 11

Comparison of mean scores on the Satisfaction with Science Class Scale of the MCI by teacher

<table>
<thead>
<tr>
<th>Mean</th>
<th>Teacher(a)</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.95</td>
<td>E1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>17.23</td>
<td>E2</td>
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<tr>
<td>12.57</td>
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<td>13.18</td>
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<tr>
<td>17.91</td>
<td>S2</td>
<td>*</td>
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<td>14.34</td>
<td>S3</td>
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<tr>
<td>16.57</td>
<td>S4</td>
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<tr>
<td>14.88</td>
<td>S5</td>
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</table>

Note. \(N = 1025\) total measured
*\(p < .05\)
\(a\)E = elementary certified teacher; S = secondary certified teacher.

The comparison of mean scores on the Competition in Science Class Scale of the MCI by teacher indicated no significant differences between any teachers. Mean scores on this scale ranged from 12.7 to 14.8.
Table 12

Comparison of mean scores on the Friction in Science Class Scale of the MCI by teacher

<table>
<thead>
<tr>
<th>Mean</th>
<th>Teacher(^a)</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
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<td>11.34</td>
<td>E1</td>
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<tr>
<td>14.27</td>
<td>E3 (^*)</td>
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<tr>
<td>16.31</td>
<td>E5 (^<em>)(^</em>)(^<em>)(^</em>)(^<em>)(^</em>)</td>
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<td>13.28</td>
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<tr>
<td>13.44</td>
<td>S2 (^*)</td>
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<td>13.96</td>
<td>S3 (^*)</td>
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<td>12.58</td>
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</tbody>
</table>

Note. \(N = 1025\) total measured

\(^*p < .05\)

\(^a\)E = elementary certified teacher; S = secondary certified teacher.

Data from the Difficulty in Science Class Scale of the MCI (Table 13) indicated that teachers E1 and E2 had classes that students perceived as less difficult than other teachers except teacher S1. Students of teacher S1 perceived science classes to be easier than those of teacher S5. High scores on this scale indicate classes perceived to be more difficult by students.
Table 13

Comparison of mean scores on the Difficulty in Science Class Scale of the MCI by teacher

<table>
<thead>
<tr>
<th>Mean</th>
<th>Teacher</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
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</thead>
<tbody>
<tr>
<td>9.89</td>
<td>E1</td>
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<tr>
<td>13.38</td>
<td>E3</td>
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<td>12.33</td>
<td>E4</td>
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<tr>
<td>12.17</td>
<td>E5</td>
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<tr>
<td>11.79</td>
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<td>12.23</td>
<td>S2</td>
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<tr>
<td>12.69</td>
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<td>12.20</td>
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<tr>
<td>13.72</td>
<td>S5</td>
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</tbody>
</table>

Note. N = 1025 total measured
*p < .05

\( ^aE = \) elementary certified teacher; \( S = \) secondary certified teacher.

Mean scores on the Cohesion in Science Class Scale of the MCI (Table 14) did not vary significantly from teacher to teacher with two exceptions. Mean scores from science classes of teacher E5 varied significantly from science classes of teachers E1 and teacher S4. High scores on this scale indicate a high degree of cohesiveness in a given teacher's science classes.

High mean scores on the Attitude Toward Science
Class Scale of the attitude instrument (Table 15) indicate a more favorable attitude toward science class by the students. Students of teachers E1, E2, S2, S3, and S4 indicated more favorable attitudes toward science class than students of other teachers. This difference was strongest when compared to teachers E3, E5, S1, and S5.

Table 14

Comparison of mean scores on the Cohesion in Science Class Scale of the MCI by teacher

<table>
<thead>
<tr>
<th>Mean</th>
<th>Teacher¹</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.54</td>
<td>E1</td>
<td></td>
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<tr>
<td>9.87</td>
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<td>10.65</td>
<td>E3</td>
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<td>10.56</td>
<td>E4</td>
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<td>9.37</td>
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<td>10.56</td>
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<td>9.62</td>
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<tr>
<td>10.33</td>
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</tbody>
</table>

Note. N = 1025 total measured
* p < .05
¹E = elementary certified teacher; S = secondary certified teacher.
Comparison of mean scores on the Value of Science of the attitude instrument (Table 16) indicates that students of teacher E3 differ significantly from students of eight of the other nine teachers. Students of teacher E5 registered scores significantly different from student scores of teachers S2 and S4. High scores on this scale indicate a better attitude toward science in a societal context.

Results on the attitude toward science in society scale have not been included. This is due to having only two items grouping on this scale.
Table 15

Comparison of mean scores on the Attitude Toward Science Class Scale of the attitude instrument, by teacher, based on 10 items

| Mean  | Teacher<sup>a</sup> | E1 | E2 | E3 | E4 | E5 | S1 | S2 | S3 | S4 | S5 |
|-------|---------------------|----|----|----|----|----|----|----|----|----|----|----|
| 40.62 | E1                  | *  | *  | *  | *  |    |    |    |    |    |    |    |
| 37.90 | E2                  |    | *  | *  | *  |    |    |    |    |    |    |    |
| 29.14 | E3                  |    |    |    |    |    |    |    |    |    |    |    |
| 34.33 | E4                  |    |    |    |    |    |    |    |    |    |    |    |
| 31.04 | E5                  |    |    |    |    |    |    |    |    |    |    |    |
| 30.26 | S1                  |    |    |    |    |    |    |    |    |    |    |    |
| 40.90 | S2                  | *  | *  | *  | *  | *  |    |    |    |    |    |    |
| 35.71 | S3                  |    | *  | *  | *  |    |    |    |    |    |    |    |
| 36.91 | S4                  |    | *  | *  | *  |    |    |    |    |    |    |    |
| 32.28 | S5                  |    |    |    |    |    |    |    |    |    |    |    |

Note. N = 1025 total measured
*<small>p < .05</small>

<sup>a</sup>E = elementary certified teacher; S = secondary certified teacher.
Table 16

Comparison of mean scores on the value of science of the attitude instrument, by teacher, based on 8 items

<table>
<thead>
<tr>
<th>Mean</th>
<th>Teacher</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.55</td>
<td>E1</td>
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<td>32.17</td>
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</table>

Note. N = 1025 total measured
*p < .05

*aE = elementary certified teacher; S = secondary certified teacher.
Qualitative Data—Teacher Interviews

The data from interviews was organized using topics from the interview transcripts. Copies of teacher and administrator interview forms are located in appendices C and D respectively. A database program was used to sort data and to look for trends by factors such as question and teacher certification.

Factors contributing to the decision to become a teacher.

A childhood teacher of the participating teachers was the single factor most frequently mentioned as influencing the selection of teaching as a career choice. Five of the ten teachers in the study mentioned this as a factor in selecting teaching as a profession. The strength of this teacher effect is demonstrated in the comments by teachers:

From an early time, probably middle school age especially with a principal who was also my science teacher, I developed an interest in teaching. From that time on I made up my mind that was going to be my profession. (Teacher S3)

Probably the most important reason was my high school science teacher. She really got me interested. I was interested in science in seventh grade. That’s when it started and then I just realized what an excellent teacher my biology teacher was and I realized that that was what I wanted to do. (Teacher S2)
Two participating teachers had worked with children prior to selecting teaching as a career field. Teaching seemed a natural evolution of this interest in children and working with children.

Well, I guess, because I like kids. I noticed that I did a lot of fun and games with children. As I got older, as a teenager my sideline you might say was to organize things within the neighborhood or community or the church to just be with kids and do things with them. (Teacher E4)

Sometimes parents influenced their young to become teachers, either by pointing out strengths and interests or by being teachers themselves. As the following statement indicates parental influence can be extremely powerful even after children are in college.

I had a talk with my mother. I took a day off and went in and talked, and we just started talking about some of the things I’d done in the past, and after we got done with the discussion found that I’d already done some work as I was growing up with kids, coached kids, and was in the Big Brother thing. And we decided that maybe education would be a route I’d want to go. So I switched over my major into Education. (Teacher E2)

Preservice preferred teaching level and reasons for selecting that level.

Generally most of the teachers participating in the study did not select middle school as their first
choice in teaching level. The tendency was for secondary certified teachers to select high school as the first choice and elementary certified teachers to select elementary as their first choice. Only three of the ten participating teachers mentioned an initial desire to teach at the middle school level.

Three of the five teachers who selected high school teaching as a first choice indicated that they preferred the more demanding academics. Elementary certified teachers did not appear to have this academic orientation in their selection process. This was one area of difference between teachers having different certification types. One teacher’s comments summed up this group when she said:

I was really academically oriented and I thought that was what was important, that you teach content, and you can do a lot more teaching of content, and I got wrapped up in that content thing, thus, choosing older kids because, of course, the younger ones and I felt at the time much of the day was spent with babysitting tasks such as finding the coats and buttoning the coats. (Teacher S1)

Elementary certified teachers had a variety of reasons for choosing that level. Reasons mentioned by elementary certified teachers for choosing either elementary or middle school ranged from a past significant educator at that level to liking the age group. One teacher who started out in a non-science
related area did not enjoy young children. Within the sample group of teachers there was no commonality of reasons.

**Reasons for currently teaching in middle school.**

The primary reason that participating teachers were teaching middle school was the presence of a job vacancy. This was common to five teachers from both preparatory backgrounds. Two teachers transferred from the elementary level to middle school in their respective districts. The importance of the opening as a determinant of the level where the individual taught is shown by four teachers’ comments:

They needed a sixth grade position so I took the number down, I called up and got a hold of (name omitted). He said why don’t you come for an interview and I got the job just like that. (Teacher E2)

That was the position. (name omitted) called me about this position. (name omitted) called me and asked me to come for an interview, and I got the job. And I was happy to have the job in seventh grade. I was coming right out of college I was looking for whatever position I could get and seventh grade was available. (Teacher S2)

That’s where the opening was when I graduated. (Teacher S4)

First job offer was in the middle school. (Teacher S1)
Teacher evaluations of their preparation to be a teacher.

Eight of the teachers in this study indicated that their preparation in methods of teaching science was poor to mediocre. This was partly because they did not start out to be a science teacher and so did not take science classes or science methods courses. Only one of the ten teachers indicated that preparation was good. The perception of poor preparation was consistent regardless of certification type. The following two teachers' comments on science preparation reinforce the perception that their training to teach science was usually poor for whatever reason:

The education program while it suggested ways to teach did not use those ways to teach themselves so — actually the instructors at the University level were for the most part poor role models — they taught the way they told us not to teach. (Teacher S4)

The preparation was just ten weeks long and the class focused very little on dealing with the reality of using an adopted textbook series or dealing with a more hands on approach which the school district when I started out was phasing out ICIS program so there was much to help you deal with the reality of being in a classroom. (Teacher E3)
Teacher evaluations of science methods courses compared to science content courses.

Teachers' perceptions of the value of preservice content and methods varied widely by teacher. The two main threads of commonality were that science content courses seemed to be either okay or very good and that methods courses were lacking in some aspect. In general this perception was similar with teachers from both preparatory backgrounds. Three teachers from both preparatory backgrounds reported having few or no science methods classes. Teachers did not seem to believe that science content classes had been poor. Comments suggested a general level of satisfaction with science content classes.

I felt better prepared in the science content courses than the science method courses. (Teacher S4)

And the content courses-- definitely I got a lot of information there. (Teacher S2)

Satisfaction with science methods classes was much lower. The cause of dissatisfaction varied from teacher to teacher, but with three teachers there had been little or nothing in the way of methods classes. Comments from three teachers reflect this.

So they were too much method oriented and you didn't have any content to deal with. This is what is out there and this is what districts are using. This is how you can use it and this is how you can
adapt it and these are things you can look for in a program to adapt to.
(Teacher E3)

I never had a science methods course.
(Teacher S3)

On science methods I was required to take a lot of science content, but science methods very little if any at all. (Teacher S5)

**Teacher views of academic work taken since working as an inservice teacher.**

Nearly all participating teachers (8 of 10) seemed to believe that additional preparation they had taken as inservice teachers had been valuable. However, this may reflect the elective nature of these courses since teachers generally choose to register for these classes. Nine of the teachers had taken course work above and beyond requirements for recertification. The following three teachers' comments reflect these ideas.

I have taken a science workshop every, almost every summer since I started teaching and I've been teaching now this is my twelfth year full time teaching.
(Teacher E4)

I've taken some hands on, a lot of hands on courses and gotten some good ideas.
(Teacher E5)

I've attended some workshops and I've attended some workshops that were at _(name omitted)_ College. And SECO-NSTA conference and that sort of thing. The
first real science classes that I'm taking is the curriculum that I'm doing at Ohio State right now. ... Overall — very, very good. (Teacher S2)

Changes in preservice preparation recommended by teachers.

Five of the participating teachers suggested that more actual classroom experience would be helpful for future teachers. A variation of this was that two teachers would like to see field experiences early in college for prospective teachers. These comments were common to teachers from both preparatory backgrounds. Two teachers suggested that courses on adolescents should be included in preservice preparation for prospective middle school teachers. Comments by teachers suggesting more preservice time in middle school classrooms are:

But if I had had the option I would say definitely in class time like where you get to go observe in the middle school or even so many weeks of student teaching at the middle school level, is what I would suggest. (Teacher E1)

I suppose if I were changing it, I would want to have more in-school classes where I am actually working with the student. When I went to school we had only the one quarter interaction and that by no means prepares you for anything you're going to face once you start. I would say most of what I have learned I have learned on the job. (Teacher E4)

When I went they waited til, I mean the only experience you really had in in the
school was a freshman experience and then your student teaching experience. Now they’ve got the kids out in the science education several quarters at different levels and different settings, different types of schools inner city vs. suburbs and so on. This is is one of the things I would have changed. (Teacher S4)

I would probably have a class that allowed the student teachers to get involved right off the bat to see if it was their cup of tea if you will. More early exposure in other words. (Teacher S5)

**Disciplinary situations.**

Interviewed teachers generally thought they had few discipline problems and any existing discipline problems were minor. One teacher commented that if there were significant problems they were not recognized as problems. The following typical teacher comments during the interview reflected the perception that discipline problems tended to be few and minor in nature.

I don’t have a lot of problems with discipline in my class. You know, if it is it’s just general talking, once the kids get used to how I operate my classes I really don’t have that much of a problem. (Teacher E2)

We don’t have any major disciplinary problems really here at (name omitted). (Teacher S4)

I don’t normally have very many discipline problems because I think of
the activity approach lessons. I think a good lesson is probably the best defense against discipline problems. (Teacher S1)

Consequences for disciplinary infractions tended to be minor and fit the teachers' perception of the infractions. The most frequently mentioned means of dealing with infractions were relatively passive such as verbal warnings or changing voice tone. Even most of the more severe consequences tended to be somewhat passive in nature as illustrated by the following comment:

...detention, effective if not detention a call home would be the ultimate weapon I guess against this and that usually works. (Teacher S4)

Two teachers mentioned that using humor helps defuse problems in the classroom and to prevent disciplinary infractions from developing.

Usually I can joke with them. (Teacher E1)

... to build a good rapport with my students. You know, sense of humor, all kinds of things kids seem to like the class, they like science, they like to the activities and things like that. (Teacher S2)

Corporal punishment was mentioned by two of the more experienced teachers as a tactic used earlier in their teaching. None of the teachers mentioned using corporal punishment now. The following comment may be
typical of the situation today in many schools.

In my early years I would use, if it was severe enough, corporal punishment would come into play. Now we have a big move on to eliminate corporal punishment.
(Teacher S5)

Problems in adapting teaching materials to student levels.

Adaptation of materials to student skill levels was approached in a variety of ways by different teachers. Common strategies used included locating information from a number of sources, using multiple textbooks, coordinating with other teachers, group work, and leveling tests according to student ability. Supplemental materials may be very important to some teachers:

Probably the major difficulty is the books that we use are --they don't give a lot of information . . . So the major difficulty is trying to get out and find information to supplement what we have so that I can incorporate it into the classroom. (Teacher E2)

And I use multi-text approach and that helps very much in that respect and usually for the unit that I'm doing I'll hunt out with all my resource books may be ten or twelve lessons and activities. . . (Teacher S1)

Three teachers expressed concern about the reading level of adopted textbooks.

The reading level of the book is set slightly above what I feel the students can handle at the sixth grade level.
(Teacher E3)
A lot of the reading is not on their level. (Teacher E5)

So I have been very aware of the fact that reading level is sometimes truly non-existent even in an eight grade student. (Teacher S3)

Two teachers expressed concerns that teaching materials were not developmentally appropriate for the level of student.

It is more concept oriented instead of content, so trying teach about chemistry and understanding what matter is, the kids aren’t formal operational thinkers yet to be able to think in abstract terms so it is real difficult to adapt to their level... (Teacher E3)

And probably more of a result of working with... an elementary teacher I put a very large emphasis on the idea of what is developmentally appropriate. (Teacher S3)

Teachers sometimes drew from several sources to develop materials and lessons appropriate to the level of the student. Two teachers addressed material development this way:

Yes, a lot of things, ideas I get in books and so on are not usually adapted to my kids level and I have to make worksheets and that is a lot of hassle. (Teacher E5)

In fact I enjoy the creativity that tries to find something for them to do to learn what I want them to learn... I put them in some kind of order and
The efforts of teachers to address learning problems faced by students echoes the student concerns that teachers deal with students having difficulty learning the material.

**Ability grouping in middle school.**

All participating teachers had classes with varied ability levels. One teacher made a strong argument for grouping students with varying ability levels in class with the comment that:

> By having a student body heterogeneously grouped you automatically make it more real world as they are going to find the rest of their life everybody with a 113 IQ doesn't show up at the same restaurant at the same time so they can discuss the same things. (Teacher S3)

There were a number of different strategies used by teachers to deal with varying ability levels. Although it was not surprising to learn that many teachers had strategies for the learning phase of the class, three teachers also used varied evaluation methods to deal with varied ability levels. Among strategies used by teachers to deal with varied ability levels were peer tutoring, cooperative learning, gearing expectations for ability, individualized help, heterogeneous grouping, and oral testing. One teacher discussing peer teaching
mentioned that:

Peer teaching seems to help a lot. It seems like a kid who’s on the lower end really appreciates another student helping him out. So I try and tend to lean towards that. (Teacher S5)

In mentioning the effectiveness of cooperative learning in varied ability classes another teacher said:

I do a ton of cooperative learning, hands on. I always provide the students with a packet that they put the information so its organized. I believe the better organized you can be the better. Again cooperative learning, working in teams. (Teacher E1)

Another strategy mentioned was using open-ended activities that allowed students to progress as far as their interest and ability allowed. Ideally the more capable student would look at the topic with more depth as one teacher mentions here:

They can go almost as far as they want with these and in depth. Hopefully the brighter more capable student can go into greater depth with these projects than somebody who’s having a little more difficulty. (Teacher S4)

At least one teacher uses other teachers as instructional resources to work with students outside of science class. In this case the learning disabled teacher serves as a resource for students needing additional help.

I also work closely with the LD teachers and let them know what I’m doing and
they can also give the extra help. One of the LD teachers has study hall with her students, and she has a guided study hall so that she will go over science with them or social studies, math, or whatever they need help in. So I work with them myself giving individual help if they need individual help. (Teacher S2)

Traits important for an effective middle school teacher.

Middle school teachers in the sample rarely identified the same traits as important for an effective middle school teacher, yet all traits were stated in a positive way. These teachers tended to look on the positive side of middle school and middle school students. This positive outlook toward middle level students was consistently a theme of desirable teachers in the study by Buckner and Bickel (1991). Two teachers believed that due to frequent schedule changes flexibility was an important characteristic. These teachers stated this quite strongly:

You need to be extremely flexible. If the schedule is changed, its changed. You need to change with it and help the students change with it because in middle school change for that middle school student really runs deep in them—my day is messed up and they are messed up basically. (Teacher E4)

An effective middle school teacher is a person who is very flexible from the viewpoint of schedules changing rapidly without warning. (Teacher S3)
While two teachers mentioned the importance of knowledge of subject matter, it did not appear to be a major consideration of most teachers. When considering professional characteristics this was the most important characteristic identified by middle school students indicating a difference in perceptions between the two groups. In one case the teacher explained the importance of subject matter as follows:

First of all one of the things is knowledge of the material. This is probably not the top thing on the list for me but I think having a knowledge of the material allows you to keep the material interesting for the student. If you're too limited then you don't know what to draw upon. (Teacher S4)

Four of the teachers mentioned a sense of humor as important for middle school teachers. Students listed being humorous as important (Buckner & Bickel, 1991), but well down the list of personal characteristics in tenth place in importance. In a later part of the interview a sense of humor was cited by a majority of participating teachers. Patience was mentioned by two of the teachers as an important asset for an effective middle school teacher. One of the teachers suggests the following reason for including patience in the list:

It takes someone who has patience with the kids as they go through their change from being children to adult, realizing
that what can happen with their mood swings within a class period or from day to day or week to week. (Teacher E3)

Some other factors mentioned, but without a great deal of commonality among interviewed teachers, are ability to adapt materials, fairness, entertaining, hands-on approach, relate to students, vary teaching style, positive outlook, respect, belief in good of children, like children, good lessons, experience, and good rapport.

**Five characteristics most important for middle school teachers.**

When the participating teachers were asked to select five characteristics they rated as most important for middle school teachers. The single trait mentioned most frequently by participating teachers was a sense of humor. Seven of the ten participating teachers mentioned this as one of the five most important characteristics. Teachers identified a sense of humor as both integral to teaching middle school students and enjoying teaching the students as three commented:

Sense of humor again-- you have to have it or. If you didn’t have a sense of humor I don’t know how you could really enjoy teaching these kids because that’s part of it and they need to see that as well. (Teacher S2)

The sense of humor is essential. (Teacher S4)
A very, very important characteristics is a sense of humor both with yourself and with your students. (Teacher S3)

Knowledge of the subject area was a close second mentioned by six of the ten teachers. Frequently this was mentioned without much elaboration by the teacher. Their comments include:

. . . knowledge of subject area . . .
(Teacher E3)

I think obviously knowledge of the subject is one. (Teacher S5)

You have to have adequate preparation in the basics of the subject area of content you’re dealing with— not a lot, but just basics, good basics. (Teacher S1)

Other characteristics mentioned, but not consistently include flexibility, compassion, creative, caring, understanding, tolerant, love children, disciplinarian, accepting, and fair.

Traits important for an effective middle school science teacher.

Participating teachers had a number of traits that they thought necessary for a successful middle school science teacher. Among these traits were hands-on approach, keeping current, fair, humor, love science, like children and discipline. More teachers mentioned a hands-on approach than any other factor.
One teacher typified this attitude with the statement:

Well maybe an effective science teacher would be to employ more hands on activities than a regular middle school teacher. I think it's important for a kid to get his hands wet doing science activities. (Teacher S5)

Desire for stronger science background.

Three of the interviewed teachers indicated a desire for a stronger science background. This was another area of separation between elementary certified and secondary certified teachers. The three teachers wishing for a stronger science background were all elementary certified. None of the three indicated that they felt hindered by this. Generally they thought the additional background would be helpful in teaching as expressed by one teacher:

So there are just a lot of things you just don't know and I don't think any science teacher can know it all. Yea, with the broad spectrum of things we are supposed to teach. That's why I say sometimes the kids have these questions that they want answers to. (Teacher E3)

Most of the teachers felt quite comfortable with their science background. When someone expressed a deficiency it was within an area of the science curriculum rather than science in general.

There are some that I have a limited background for. So when I go to teach a unit on space, I get spaced out because that is not my strongest area and that bothers me. (Teacher E4)
Probably the time it comes most apparent is out in a setting that you're, for an example say Outdoor Ed because that is probably one of my weakest areas is knowledge of the plants and along the trail, for example, wishing you knew some of the plants and the folklore that went with those plants. I think in the classroom you're pretty safe because you've structured the lesson and everything is pretty much under your control, maybe more so than in an outdoor situation. (Teacher S4)

Two teachers stated that they researched topics if they did not feel adequately comfortable with their existing knowledge base. They did not appear the least hesitant to do the additional research to reach the desired comfort level with a given topic.

If I'm ever in doubt I know where to look. I know how to research and find information. I always make sure I do know my subject matter very thoroughly before I do present it to the class. (Teacher E1)

If there is some areas that I'm really not up on all I have to do is go look it up whatever it is and I feel very comfortable with that. (Teacher S1)

Typically most participating teachers were satisfied with the extent of their science preparation. When they thought there might be a deficiency they considered it minor.

Importance of knowledge of subject matter.

All but one of the interviewed teachers thought that knowledge of subject material was at least
moderately important. Some thought that knowledge should be broader based rather than with great depth in specific areas. This was an area where teachers tended to be more in agreement. Three statements suggested reasons that knowledge of material helps teachers instruct better.

Real important because the kids can tell through your lecture or talk or discussion when I go over the material whether you’re up on things or not. (Teacher E2)

A lot of kids will start asking questions beyond the textbook and you sort have to be on your toes to answer them or at least to know how to find the answer. (Teacher S5)

You have to know your material to teach it, but you also have to be able to know and be able to relate it to the students you are working with. (Teacher S2)

**Effectiveness of extra science coursework.**

Most of the participating teachers believed that coursework taken in science was effective in making them better teachers. Two comments were made about the way the additional knowledge allowed different types of presentations of the material.

It gives me more confidence in the factual information for that subject area. Oftentimes the course I would take had with it as well ways to present it and hands on approaches . . . (Teacher E4)

It opens up those areas that I wasn’t
that familiar with and forced me to
delve into some of the, you know, parts
of the discipline that I was not
familiar with so, yeah, it gives you an
overall background and it did help in
filling in the holes where I just didn’t
have the knowledge. (Teacher S1)

One teacher disagreed strongly with the idea that
extra science made a better teacher. The rationale
used was that:

More effective than if you hadn’t had
that course work? No. Again because some
of my, you know I was required at (name
omitted) to take quite a few science
courses and being in field of education
at that time I was amazed at how many
professors had no educational
background. They were just hired I think
mostly for research and boy, they may be
the brightest in their field but, boy,
were they terrible teachers. (Teacher
S5)

Additional teaching methods training.

Teachers generally expressed a desire for a
better background in classroom management skills.
Related to this, three expressed the thought that
classroom experience was extremely valuable, while
three others expressed a desire for additional science
methods. One teacher had the following comments on
the problems faced by a beginning teacher:

Like I said I felt real strong in
content, but, you know, walking into the
classroom, and being in charge and
having to deal with the discipline, and
having to deal with the classroom
management, and having to deal with all
the other paper work, not grading
paperwork but all the other paperwork. . . (Teacher S2)

Comments on classroom experience or situations similar to classroom experience where learning could take place appeared quite valuable to participating teachers as three commented:

The best teacher for me. I've subbed, since I was a sophomore in college and being in there being in the classroom, trial and effort is the best teacher. (Teacher E1)

As long as it was on the job training. I don't feel that the method courses of what I had are the way to do it. You need to be on the job with an experienced teacher learning from them, watching how they handle things. Getting a general feel of what is going on because there is a lot more to conducting a class and being a teacher than just teaching material. (Teacher E4)

If they were redone to represent what is going on in the real world of teaching just as much could be accomplished in the same amount of time . . . (Teacher S3)

Relationship with students.

When asked about their relationship with students seven of the ten participating teachers described their relationship with students as good or better. Words that appear in describing teacher/student relationships are rapport, caring, and trust:

I would say that (I) have real good rapport with my kids. Real good rapport. (Teacher S2)
My opinion is that I have excellent rapport with just about all of my students and part of that is because I have that established at the start that I really care about the kids deep down. . . (Teacher E3)

I think I have good rapport with the students. (Teacher S1)

I feel we have a good relationship. I think the students respect me and enjoy being in my class and I enjoy them and respect them so I think it’s a pretty good relationship. (Teacher S4)

One teacher expressed what could be described as unbridled enthusiasm for the students in the following:

I love‘em. I like‘em . I love‘em. They’re great. (Teacher E1)

Two teachers expressed some frustration that class changing prevented the close relationships that develop in a self contained classroom in the typical elementary class:

As far as knowing them-- fairly well, not nearly well as if you could if you had them more often. (Teacher E4)

It isn’t the same as in a self-contained classroom and I miss that. Sometimes in the hurry from one class to another and our sixth graders think we don’t care and I know some need a close relationship. And yet for most of them it works. (Teacher E5)

Perceptions of percentage as teacher and friend.

Teachers were asked to estimate student
perceptions of their teacher/friend relationship with the students in the classroom. This was expressed as a percentage for each role. For example; fifty percent teacher/fifty percent friend. Percentages ranged from fifty percent friend and teacher to eighty percent teacher/twenty percent friend. None of the teachers saw themselves as more friend than teacher. Teachers expressed a number of different rationales for this rating of percents. Four saw the job more as instructor than as friend:

I see sometimes people trying to get that percentage higher as a friend and I can see where that could be a disadvantage. (Teacher E2)

I would hope more teacher than friend. I really don’t try to be their friend. (Teacher E5)

At this level it is more of my job to provide an education academically than to be their friend. . . . On the other hand realistically to do my job for what I’m paid to do and what I’m obligated to do, the 75:25 is more reasonable. (Teacher S3)

My overall goal is to do a good job, to get them to learn science. (Teacher S1)

Two teachers expressed a desire to be more of a friend to the students, but for whatever reasons thought it rarely happened.

Some get a little closer than others depending on the personality and depending on the things you have to deal with. But I think it would be rather nice to have a greater percentage of
them get to know me as a friend.  
(Teacher E4)

Yes, I would like to get it down a little better towards the 50:50. However I think 50:50 would be overdoing it.  
(Teacher S3)

**Use of humor in class.**

One of the strongest areas of agreement from teachers during the interview related to the use of humor in the classroom. When specifically asked about the role of humor in the classroom every teacher said that humor was included in teaching at the middle school level. While many justifications were mentioned for using humor most were related to making class and learning fun and enjoyable as some of the comments indicate:

It just helps keep them going. Lets them know that I’m human also. (Teacher E2)

I try if I can start off the class something humorous or something funny happens in the class try to turn it around and use it and move the class along. (Teacher E3)

So I sing my little songs and I do my little dances. I take the things we are doing an hook them around and make them fun. I’m known as being kind of crazy at times. (Teacher E4)

If I can’t have fun and the kids can’t have fun what are they going to learn? (Teacher S2)

**Teacher enthusiasm in class.**

The participating teachers agreed that enthusiasm
was important. Reasons mentioned included selling the subject and holding the students' attention by being entertaining. The following comments leave no doubt as to the importance the teachers place on enthusiasm.

I mean unfortunately probably too important for the kids. I mean you really have to be an actor. You got to keep them on the go all the time. (Teacher E2)

If you ask them who their favorite teachers are they're going to say the ones that are the most entertaining and most enthusiastic, so you have to try to come in no matter what and be out there and be ready. (Teacher E3)

If you're not enthusiastic about what you are teaching, the kids aren't going to be enthusiastic about what they are learning. (Teacher S2)

The more enthusiastic, number one the better chance you have surviving at the middle level. (Teacher S3)

Have to be really enthusiastic. I think you have to be a salesperson and I think you have to do some role playing and you have to act like it's fun because if you don't act like it's fun, they aren't going to respond. So you have to really do a sales job. (Teacher S1)

One teacher added a cautionary comment:

It should be buffered with an air of sincerity. (Teacher S3)

**Use of unexpected events in class.**

In using unexpected events most teachers relied on current events as their source. Two also mentioned
utilizing unexpected happenings in class as lesson sources. These teachers mentioned two examples:

Like if somebody spills water and we can use that to look at surface tension and learn from most anything that happens. I use that a lot. (Teacher E5)

If something goes wrong with them or an activity turns out completely differently than it is supposed to we talk about why it did that. What we might have done wrong or what happened to make it happen that way. (Teacher S1)

One of the earlier interview topics dealt with flexibility in teaching at the middle school level. Comments of the interviewed teachers showed their flexibility when discussing the use of current events in the classroom.

I’m not locked into my curriculum. I’m not locked into my lesson plans. . . . as result of what happened last night with the satellite and the space shuttle we’ll spend part of the day discussing that. There is no way I could have written that in my plans because it only happened last evening. I try to keep things as current as possible. (Teacher S3)

A current event if it is related to science just because we’re having not to be on a subject we’ll drop what we’ll do and cover that event. (Teacher S5)

Well like for example a volcanic eruption we are doing something in class and heavy volcano or earthquake occur
then I might bring in something from the newspaper, something from on the news, kind of share what went on that day.  
(Teacher S4)

**Variation of difficulty of questions.**

Teachers in the interview appeared to have little commonality in strategies for varying question difficulty. Some of the strategies mentioned included group questioning, working from rote questions to abstract questions, avoiding yes or no answers, and varying questions with student ability level. One teacher whose students are sometimes ability grouped let the class composition guide questioning strategy.

**Personal change as a teacher with experience.**

During the interview teachers were asked how they thought they had changed as teachers with increased experience. The single factor mentioned most was greater flexibility as a teacher. One teacher contrasted rigidity as a beginning teacher with a more flexible style today.

I started out as a rigid—here's the textbook even though it was five years old, here's the curriculum, follow it . . . . .if I feel it is important and if I feel I can justify it within the framework of curriculum the students are probably going to be exposed to that particular learning idea. (Teacher S3)

Other teachers described this flexibility as a form of mellowing out over time. Three reported having a more
relaxed attitude toward the students and the curriculum that made them more flexible.

I think at the beginning of my career I felt that I had to get through a particular chapter by the end of the year and I just don't feel like that anymore. (Teacher S5)

In some ways I've mellowed. I am not so straight line demanding possibly as I was as a new teacher. And yet I know how to get what I want out of them in more round about ways. (Teacher E5)

A number of changes reported by teachers also reflected increased flexibility. One teacher mentioned accepting late work now, another now tends to find more issues that are not simply black and white in teaching as mentioned below. The passage also reflects more concern with the class at a level other than the subject being studied.

I see myself as mellowing. Everything's not particularly so important as an overall atmosphere, an overall rapport, overall sense of well being so I guess I see a lot more gray. It's not just black and white anymore and there are a lot of reasons why this might not happen the way it's supposed to or that might not happen and I think I see myself as bending a lot more in the gray area. (Teacher S1)

Teacher change with experience.

Participating teachers did not have a strong consensus on the way teachers in general change during their careers. Overall there seemed to be the idea
that some teachers become better with time. The feeling was that teachers who did not become better tended to stagnate or burn out. Nine teachers mentioned specific changes that contributed to being a better teacher without saying they became better. One teacher presented a good description of teacher maturation where the teacher improves.

Because when you first start off . . . you’re not sure what the rules are and how far you can go, and you don’t know a lot of those characteristics, and how they come out in different ways. You’re not familiar with their backgrounds and a lot of those different things, you can make some big mistakes and I feel that I’m a lot more confident at that. I can make decisions and maybe make them a little better. (Teacher E4)

Two teachers mention the dichotomy of teacher development in which some teachers remain fresh and excited about teaching awhile others stagnate.

I find it frustrating when teachers just get into a routine and use the same lessons over and over again and I just find that frustrating. . . . I also do see those teachers . . . . . . . grab the bull by the horns, they’ll change if something didn’t work they will stop now and fix it and go on or they’re just not afraid to try. (Teacher E1)

A lot of times you run into people who that, an overused phrase perhaps, burn out and can’t wait to get out of teaching, don’t want to put a whole lot of effort into it. Then you have the others that contain—that continue to have a certain amount on enthusiasm and
continue to enjoy it maybe even more so than when they first started. (Teacher S4)

**Differences between elementary and secondary trained middle school teachers.**

When asked about differences they noticed between middle school teachers with an elementary preparatory background and those with a secondary science background the majority of the teachers thought that secondary science trained teachers had more of a subject or textbook orientation. The same teachers thought elementary trained teachers had a broader focus and were more student-oriented. Two of the teachers were undecided about this, but the other teachers generally had this opinion in varying degrees of strength. Comments from the teachers supporting this concept include:

The few instances I have seen the ones that come from the high school level seem to be more content oriented. The ones that comes from an elementary background are the ones that lean a little bit more towards the counseling issues, and are more concerned about the kids than the content . . . (Teacher E3)

I guess that elementary has a little bit more student-oriented while we are subject oriented, but the more you are in a middle school setting, the more you adapted I think to dealing with the student. (Teacher S2)

I think they are more academically oriented than elementary teachers are or tend to be more academically oriented.
Elementary teachers are a lot more interested in the whole child and if they're going to do science they'll pick out several fun things to do. (Teacher S1)

Table 17

**Important teaching behaviors for effective middle school teaching as identified by authors, researchers and teachers in the study**

<table>
<thead>
<tr>
<th></th>
<th>Johnston</th>
<th>Buckner</th>
<th>Tobin</th>
<th>Ele</th>
<th>SSci</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive self-concept</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>warmth</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enthusiastic</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| flexible                                        | X        | X       |       | X   | X
| spontaneous                                    | X        | X       |       |     |      |
| accept students                                 | X        | X       |       |     | X
| developmentally aware                          | X        | X       |       |     |      |
| subject knowledge                               | X        | X       |       | X   | X
| vary instruction                                | X        | X       |       |     | X
| structure instruction                           | X        |         |       |     |      |
| monitor learning                                | X        | X       |       |     |      |
| use concrete methods                            | X        |         |       |     | X
| varied questions                                | X        | X       |       |     |      |
| indirect teaching                               | X        |         |       |     |      |
| positive behaviors                              | X        | X       |       |     |      |
| individual needs                                | X        | X       |       |     |      |
| listens                                         | X        | X       |       |     |      |
| friendly                                        | X        |         |       |     |      |
| optimistic                                      | X        |         |       |     |      |
| humorous                                       | X        |         |       |     | X X |
| fair in grading                                 | X        |         |       |     |      |
| easy to understand                              | X        |         |       |     |      |
| organized for class                             | X        |         |       |     | X
| available to students                          | X        |         |       |     |      |
| sustained student engagement                   |          |         |       |     |      |
| increase science understanding                  |          |         |       |     | X
| student activity participation                  |          |         |       |     | X
| good learning environment                       |          |         |       |     | X
| consistent                                      | X        |         |       |     | X X |
| compassion                                      |          |         |       |     | X
| creative                                        |          |         |       |     | X


Table 17 (continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>professionalism</td>
</tr>
<tr>
<td>cooperative</td>
</tr>
<tr>
<td>caring</td>
</tr>
<tr>
<td>understanding</td>
</tr>
<tr>
<td>fair</td>
</tr>
<tr>
<td>like teaching</td>
</tr>
<tr>
<td>showmanship</td>
</tr>
<tr>
<td>general knowledge</td>
</tr>
<tr>
<td>firm</td>
</tr>
<tr>
<td>tolerance</td>
</tr>
<tr>
<td>counselor</td>
</tr>
<tr>
<td>disciplinarian</td>
</tr>
<tr>
<td>like children</td>
</tr>
<tr>
<td>thick skinned</td>
</tr>
<tr>
<td>demanding</td>
</tr>
<tr>
<td>prepared for class</td>
</tr>
<tr>
<td>belief in self and student</td>
</tr>
</tbody>
</table>

Comments from two teachers indicated that teachers from each background may move toward a common classroom orientation:

The people I teach around are, because their elementary backgrounds, have influenced me to do things more, to do things the way I do. Because I used to be pretty rigid. (Teacher El)

But the more you are in a middle school setting, the more you adapted I think to dealing with the student. (Teacher S2)

A summary of teaching characteristics identified by writers, researchers, and teachers participating in the study may be found in Table 17.
The following administrative interviews were conducted to contextualize results rather than address the research problem.

Qualitative Data-Administrator Interviews

Preferred level of administration.

During interviews with the principals of the three buildings only one of the three indicated initial preference for working at the middle level. One other wanted to work at the secondary level and ended up working in the middle school. A major factor for selecting middle school administration for two of the three was teaching experience at the middle level. In practice the three middle level administrators choices were governed by the opening of the position as described by one administrator:

Path to being a middle school administrator.

All three interviewed administrators were at the middle school level due to an opening at that level. The following administrator's comment is typical of the administrative path to the middle level.

That was where the opening was for an administrative position. I taught middle school. I taught two years fifth grade, taught all subjects and then moved to middle school where I taught reading and social studies and when this instructional leader position opened I applied for it and then received this
Preparation for being a middle level administrator.

None of the administrators felt that they had received academic preparation specifically for the middle level. All of them had classroom experience at the middle level so they were not without practical experience. Among suggestions from administrators for changes in preparation of middle level administrators was course work aimed specifically at middle level situations and more field experience at the middle level. One administrator thought that certification specifically for middle level administration was needed.

Changes administrators would like to make.

None of the three administrators perceived the same characteristics as being unique to middle school. The three districts are located in somewhat different settings which may contribute to this diversity of opinion. When asked what changes they would like to make each administrator had a different agenda. One administrator commented that teachers tended to move to the middle level after becoming dissatisfied at the elementary or high school level. The administrator expressed this frustration:

I guess right now I'm kind (of) on this thing of feeling like the middle school tends to be a dumping grounds... The high school teachers that are kind
of, you know, they're uncomfortable up there for one reason or another so they maybe see this as a one way to get out of the pressure cooker a little bit. Elementary teachers sometimes, for one reason or another, just aren't happy where they are think "Oh, I'll go to middle school that's a pretty good deal." (Administrator A3)

The middle school concept.

Participating principals were asked how they would define the middle school concept. Themes mentioned showed quite a bit of commonality as well as some characteristics unique to each principal. Themes mentioned by the principals included exploratory period, transitional elementary to high school, broadening of academic experience, and nontraditional instructional methods.

Perceived quality of incoming teacher preparation.

Two of the three principals felt that incoming teachers were at least adequately prepared academically. The third principal thought quality of preparation varied from teacher to teacher. In mentioning preparatory background of teachers one principal commented:

I'd have to say it is still the traditional—secondary trained people were, had better knowledge of their subject matter, but my elementary people had a better understanding of the whole child. Pretty traditional viewpoint. (administrator A2)
Another principal echoed this idea saying:

One thing I see is because we can (hire) either--people with either a secondary, high school certificate or an elementary certificate qualify to teach at this level sometimes we have people who are really into their subject but don’t have some of the skill, experience to deal with this early adolescent and we get elementary people who are really student-oriented and have all those skills who are short a little bit in the content area. (Administrator A3)

The third principal in a district that hires mostly elementary certified teachers theorized that teachers in that district were not comfortable in science by saying:

Science is usually the last, least preferred (subject area) because I just think most of the students feel that they don’t have adequate preparation when it comes to science. (Administrator A1)

Necessary components of middle school teacher preparation.

When asked about what they thought was needed for future middle school teachers all three principals included psychology of middle school aged students. Two of the three wanted more subject area knowledge. One of these two identified math and science as two areas requiring greater knowledge on the part of the teacher. The third principal perceived a need for more classroom experience with middle school aged
Disciplinary situations.

Two of the three principals indicated outright that the classroom teacher should handle as many of the discipline problems as possible. The third principal implied this as well. Another strategy mentioned was to involve the parents or guardian at some point. Two of the principals mentioned that a school plan was in place for disciplinary measures.

Traits important for an effective middle school teacher.

Mentioned by the administrators as traits of an effective middle school teacher were flexibility, interested in working with middle school child, a little crazy, empathy for middle school children, know how to reach and motivate, good listener, ability to individualize instruction, understanding of the uniqueness of the child, and the ability to deal with children individually. As one principal commented:

You have to like this age kid. If not, you need to get out of this particular business and either go into elementary or high school or whatever you are suited for. You got to like the kid. You got to be in their shoes and try to think about where they are coming from and if you can relate to your own personal experience in middle school that you went through. (Administrator A1)

When asked to identify five characteristics of an
effective middle school teacher the principals had few overlapping characteristics. These listed characteristics included patience, knowledgeable, enthusiasm, creative, motivating, ability to form relationships with students, a little "goofy," variety of teaching techniques, understanding educating total child, flexibility, assertive without being too forceful, respect for the child, and sincere interest in building positive student self concepts and attitudes.

Five characteristics most important for middle school teachers.

Two of the three administrators identified a hands on approach as important characteristics for an effective middle school teacher. Other characteristics identified by administrators included good subject knowledge, multiple teaching modes, broad science background, environmentally stimulating room, curriculum variety, current with technology and science, and allow for individual differences. The overall image of the type of teacher described by the principals would be a knowledgeable, involved individual.

Importance of knowledge of subject matter.

All three administrators rated knowledge of subject as "somewhat important," although there was
some feeling that other factors might be equally important. One administrator describing the relationship between science knowledge and the teaching of science at the middle school commented:

Most people don’t want to be science teachers at the middle school level. . . . Probably since high school they have had one or two classes at the college level. So the person who can come to us as elementary certified has minored in science or really taken extra classes is a real plus. Those are people that we want to slot into the science program. The people that can get away from the textbook, that can bring other outside activities into the science classroom, I think they’re much more successful than someone who just goes through the teacher’s handbook and that sticks pretty much to the subject matter. (Administrator A1)

Use of humor.

All three administrators thought that humor was very important in the classroom. In this area there was total agreement with the participating teachers. Two of the administrators mentioned that humor need not be apart from the students. Teachers and pupils could laugh together. The third administrator added a caution saying:

I don’t think anything that would (be) closely related to sarcasm or that kind of humor would have any place in the classroom, any kind of destructive, cutting humor. (Administrator A3)

There was a feeling that humor helped the learning
process in the classroom by lightening the learning atmosphere.

**Teacher enthusiasm.**

All three administrators rated teacher enthusiasm as very important to middle school teachers. One principal summed up this idea with the thought that:

> Teachers (have) got to be enthusiastic if they’re not, then how do we expect the kids to be enthusiastic. (Administrator A1)

Additionally, one principal commented that the personal appearance of a teacher could affect the way students reacted to the teacher, students might not perceive an older teacher as being as interesting saying:

> Oh I think probably this age group kid can’t, they can’t somehow see past what’s on the outside, at least for the initial impression, so if somebody looks like they are going to be boring, or they look old, or, you know, they or whatever way these kids don’t see that person as being attractive they are going to turn them off. Now through the enthusiasm of that teacher and I’ve had teachers of all ages and all sizes and sexes and everything else the kids like, but it didn’t have anything with their looks, but their enthusiasm and some of the other things. (Administrator A3)

The principal saw teacher enthusiasm as one way of making up for differences in appearance.

**Teacher change with experience.**

All three administrators generally felt that
teachers became better with experience. One principal mentioned that it really seemed to take three years of teaching to "get into the swing of things."

Characteristics developing with experience mentioned by administrators included avoiding many new teacher mistakes, more of the total school picture, experience helps reach children, and tend to master the tricks of the trade. One administrator thought that the teacher's perspective toward teaching began to change as they started having their own children. Another principal while mentioning that most teachers improve with time stated that a few "burn out." The goal of this principal was to have teachers that combined the experience developed through years of teaching with the enthusiasm associated with most beginning teachers.

_Differences between elementary and secondary trained middle school teachers._

Two of the three administrators perceived that secondary trained teachers tend to be more subject oriented while elementary trained teachers are more student or whole-child oriented. These administrators discuss these differences in the following comments.

I think after they (secondary trained teachers) are here with us for a year or two then they realize, what I'd say, interact with their fellow colleagues the whole child becomes very important and the subject matter is no longer the
predominant, necessarily, thing that they are doing in the classroom.
(Administrator A1)

The subject, secondary trained person is still, the number one emphasis is the subject matter. Get through the curriculum. Teach all the skills. Have we got them ready for the proficiency test. That kind of philosophy. They are not as concerned about the social/emotional. . . .Elementary more “let’s look at the total child, what’s going on here” . . .
(Administrator A2)

The third principal thought there was little difference between the two certification types at the middle school level. However, this administrator did mention two differences: 1) elementary personnel frequently lacked a complete science background and needed to take additional courses to improve their knowledge base; 2) elementary trained teachers were better at tying different areas of the curriculum together because of their experience in a self contained classroom.

Staff hiring factors.

When asked about factors considered when hiring new personnel the administrators considered a number of different factors when hiring middle school teaching faculty. One principal preferred hiring teachers with experience. Generally the more experience the teacher has the more likelihood of being hired. No preference was noted for either
elementary or secondary certified personnel when hiring except that teachers hired for seventh and eighth grade math classes tended to be secondary certified. The same administrator also mentioned hiring teachers meeting North Central certification standards. Another administrator commented that hiring was generally restricted to elementary certified teachers. Other factors mentioned by the principal included having a good personality to work with middle school aged children, common sense, creativity, dedication, motivation, and excitement. The third administrator commented:

To be very honest with you I’m still probably more prone to take an elementary person in certain areas. It gives me more flexibility . . . I have to have the flexibility to move some of these teaching assignments around and I can’t do it with secondary people. I will have to be very honest and say that in the secondary I am much more inclined in the areas of math and science to take secondary people and keep a balance of secondary in those areas than in language arts. (Administrator A2)

The administrator went on to say that the qualifying factor was teacher quality. The type of certification held by the teacher was unimportant as long as the person was a good teacher.

When asked if hiring was done for specific positions or for someone to fit into the middle school in general all three administrators indicated that the
type of opening had at least some impact on the person hired. One administrator mentioned that teachers were usually hired for a specific position. The other two tried to hire teachers to fit into the middle school, but sometimes found that the opening dictated the qualifications of the teacher hired.

**Sharing hiring decisions with existing staff.**

All three administrators usually consulted with some staff members for decisions on hiring new staff members. Two of the three consulted with leaders within their schools. The third had a set policy for involving teachers in the process of hiring new educators.

Three of the ten participating teachers were hired by any of the three administrators. Two participating teachers in one district and one from another were hired by the interviewed administrators. Comments from the administrators indicated that factors mentioned earlier played major roles in the selection of these personnel.

**Qualitative Data-Classroom Behavior Observations**

Observations of classrooms indicated a difference in occurrence of what Buckner and Bickel (1991) termed personal and professional behaviors based on the
certification of the teacher. Behaviors of each type were identified on the observation form in Appendix C. Elementary certified teachers, during observations, were much more likely to use behaviors considered personal (particularly; willing to listen, accepts students, warmth and kindliness, friendly, respectful to students, and humorous) than to use behaviors classed as professional (most frequently used includes; know subject, takes extra time for those who need it, and compliment for good job) by Buckner and Bickel (1991) (Table 18). The difference in means between personal and professional behaviors was significantly different with \( p = .05 \). For example, Teacher E1 had twenty observed uses of personal behaviors compared to four observed instances of professional behaviors. In contrast Teacher S2 had twenty-six observed uses of personal behaviors compared to fifteen observed instances of professional behaviors. Elementary certified teachers averaged 5.2 observed instances of professional behavior per class compared to 4.2 instances for secondary certified teachers. In contrast, secondary certified teachers averaged 2.8 observed instances of professional behavior per class compared to 1.5 observed instances for elementary certified teachers. Although the
Table 18

*Frequency and category of classroom behaviors observed during classroom visitations.*

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Observations</th>
<th>Personal Behaviors</th>
<th>Professional Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>4</td>
<td>31</td>
<td>4</td>
</tr>
<tr>
<td>E2</td>
<td>4</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>E3</td>
<td>4</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>E4</td>
<td>4</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>E5</td>
<td>3</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>S1</td>
<td>3</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>S2</td>
<td>4</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>S3</td>
<td>4</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>S4</td>
<td>2</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>S5</td>
<td>4</td>
<td>19</td>
<td>11</td>
</tr>
</tbody>
</table>

A difference was much less, behaviors classed as personal were exhibited more frequently than behaviors classed as professional. Data for behaviors by individual teachers may be found in Table 19.

Many of the behaviors observed were governed by the type of lesson in the classroom on a given day. For example, testing occurred during several
Table 19

*Frequency and category of classroom behaviors observed during classroom visitations for individual teachers*

<table>
<thead>
<tr>
<th>Personal Characteristics</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>willing to listen</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Respectful toward students</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>accept students</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enthusiastic</td>
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<td>1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>optimistic</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>warmth and kindliness</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>friendly</td>
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<td>3</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>flexible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>humorous</td>
<td>12</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

| Professional Traits                           |    |    |    |    |    |    |    |    |    |    |
| know subject                                  | 2  | 2  |    |    | 1  | 2  | 5  |    |    |    |
| check to be sure                              | 1  | 1  | 1  |    | 6  | 1  | 1  |    |    |    |
| all understand                                |    |    |    |    |    |    |    |    |    |    |
| aware some students                           | 1  |    |    |    | 2  |    |    |    |    |    |
| need extra help                               |    |    |    |    |    |    |    |    |    |    |
| takes extra time for those who need it        | 2  | 1  |    | 6  | 4  | 2  | 5  | 4  |    |    |
| well organized for class                      | 1  |    |    |    | 1  |    |    |    |    |    |
| makes sure students have success with new material | 1  |    |    |    | 1  |    |    |    |    |    |
| easy to understand                            |    |    |    |    |    |    |    |    |    | 1  |
| careful to correct students who don’t pay attention | 1  | 1  | 1  | 1  | 1  |    |    |    |    |    |
| use variety of materials and activities       |    |    |    |    |    |    |    |    |    |    |
| compliment students for doing good job        | 1  | 3  | 3  | 1  | 1  | 5  | 1  | 3  | 5  |    |
| ask easy average and difficult questions       |    |    |    |    |    |    |    |    |    | 1  |
observation periods thus restricting opportunities for behavior observation. Days when testing occurred in the classroom were omitted from average values for this reason. Six classes watched videocassettes which tended to reduce opportunities for observing behaviors.

During classroom visitations observations were made into the number of different teaching/learning events that happened in each class. Secondary certified teachers averaged slightly more events during the course of a class than elementary certified teachers (Table 19). More events should translate into more diversified instructional methods in the classroom.

Classroom observations indicated that secondary certified science teachers were more likely to have classroom activities rather than lectures with worksheets as part of the teaching/learning process. Four of the five secondary certified science teachers had classes involved in activities during at least one observation period. Only one elementary certified science teacher had an activity as part of the teaching/learning process.
Table 20

Average number of Instructional Activities per teacher during classroom observations

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Observations</th>
<th>Average Number of Activities per Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>3</td>
<td>2.3</td>
</tr>
<tr>
<td>E2</td>
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<tr>
<td>E3</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>E4</td>
<td>4</td>
<td>3.0</td>
</tr>
<tr>
<td>E5</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>S1</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>S2</td>
<td>3</td>
<td>3.7</td>
</tr>
<tr>
<td>S3</td>
<td>4</td>
<td>2.8</td>
</tr>
<tr>
<td>S4</td>
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<td>2.0</td>
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<tr>
<td>S5</td>
<td>4</td>
<td>3.3</td>
</tr>
</tbody>
</table>

During the observation periods, video (VCR) was used in classrooms of three of the five elementary certified science teachers. In contrast, video was used in the classroom of only one of the five secondary certified science teachers during the
observation periods. Otherwise, lesson content used by teachers from both certification backgrounds was similar.

From a purely subjective point of view, the researcher noted a variety of classroom teaching styles. Although many types of classroom settings were noted no one style consistently appeared characteristic of teachers from either preparatory background. Most of the classrooms looked like "typical" classrooms with science related paraphernalia decorating much of the room. Two classrooms with elementary certified teachers did not have this type of decor, however this may have been related to the curriculum at that time. Both classrooms were in the health portion of the curriculum at the time of the observations. The classroom of a third elementary certified teacher in the same school very much fit the image of a science classroom with curriculum related materials decorating the room.

Although interviewed teachers mentioned using cooperative learning only one teacher used cooperative learning during classroom observations. Every teacher at one school mentioned using cooperative learning, yet cooperative learning strategies were not used during any classroom visitations at this school.
Chapter V

Discussion

Young adolescents are usually considered to have unique characteristics that set them apart from younger and older students. Ironically, middle school teachers have more variety in their certification than teachers at any other level (Epstein & Mac Iver, 1990). Additionally, McPartland (1990) mentions the perception that elementary trained teachers have a student centered orientation while secondary trained teachers tend to be more subject oriented. Do these factors actually exist, and if so how do they interact in the education of young adolescents in the middle school? This study attempts to help answer these questions.

The first research question related to teachers’ perceptions of their preparatory backgrounds. Interview data were used to look at both subquestions in Problem 1.
**Problem 1:** How do middle school science teachers perceive their preservice background both in science and in pedagogical techniques?

**Sub Problem A:** Will teachers from a non-science background perceive their teaching background as adequate for teaching middle school?

In general, using interview data, teachers from both preparatory backgrounds perceived their backgrounds as being mediocre. The age of participating teachers may be a factor in this perception. Because the sampled population consisted primarily of older, experienced teachers who received their education as much as fifteen and twenty years ago, science method courses may not have been a common requirement at that time since several of the interviewed teachers mention not having science methods classes. The data suggests that generally what science content courses taken were valuable since teachers were generally positive about their science content preparation. The preparatory background takes on increased significance since all but one of the teachers indicated that knowledge of subject matter was important.

Two of the elementary certified teachers mentioned doing extra work to obtain the subject knowledge required to teach their science classes.
However, problems appeared to be related to lack of breadth in science course-work rather than the quality of undergraduate science course-work. Three of the participating elementary teachers wished for a stronger science background. Considering that many teachers having elementary certification have taken few science content courses, this is not surprising. Tobin et al. (1990) observing classes noted that exemplary teachers teaching out of their specialty area lacked some of the traits that made them exemplary teachers within the specialty area. It appears possible that this difference may also occur between teachers with the two certification types due to the differences in science content background.

Two of the building administrators added credence to this idea. One administrator commented that the elementary certified teachers in her/his building tended to select science last as a teaching choice. The administrator attributed this to the teachers not feeling qualified to teach science. A second administrator thought that secondary trained teachers had a better grasp of science knowledge than elementary trained teachers.

Sub Problem B: Will teachers from different preservice backgrounds perceive teaching differences between the two preparatory backgrounds?
The majority of the participating teachers thought that secondary trained teachers had what McPartland (1990) termed a "subject centered" orientation while elementary trained teachers tended toward a "student centered" orientation. Another way this has been stated is that secondary teachers teach subjects and elementary teachers teach children. This perception was shared by two of the three administrators. The third administrator perceived little difference in teachers with the two types of certification except in two areas. This administrator mentioned that elementary trained personnel often lacked a complete science background and needed to take additional courses to build their knowledge base. However, the same administrator thought elementary trained teachers were better at connecting the different areas of the curriculum because they had experience in self-contained classrooms.

Whether the perception of secondary teachers' subject orientation versus elementary teachers as being student oriented is accurate may still be open to debate. However, the tendency of elementary teachers in this study to use classroom behaviors described as "personal" (Buckner & Bickel, 1991) with a greater frequency than secondary certified teachers supports this perception. Several of the secondary
certified teachers chose to teach science because of fondness for the subject, a fact that might imply somewhat of a subject orientation.

An additional factor to consider in this study is the experience level of participating teachers. The teachers participating in this study had an average of nearly 16 years of teaching experience with just over 13 years at the middle level. Interviewed administrators felt that generally most teachers become better with experience. This perspective was generally shared by participating teachers. The implication of this is that teaching characteristics become more adapted to the teaching situation at the middle level as teachers gain experience at that level. Supporting this idea one administrator commented that after teaching at the middle level for several years secondary trained teachers realize that the subject is not necessarily the most important part of teaching. Another principal mentioned that elementary certified teachers frequently took college courses to alleviate deficiencies. These data suggest a merging of teaching characteristics for teachers from the two preservice backgrounds.

Problem 2: Will student perception of the learning environment be related to the preparatory background of the teacher?
No significant differences were noted in the classroom environment as measured by The My Classroom Inventory based on the certification of the teacher. Mean scores on the difficulty scale showed the greatest divergence, however this difference was not significant (alpha = .05). It may be that the high experience level of all the participating teachers lessened any differences that may have existed initially or perhaps there is no difference based on certification type.

Three different scales were used to measure attitude toward science. Again, no significant difference existed between teachers of the two certification types. The greatest difference in means was noted in the scale to measure science in society, however this difference was not statistically significant. Factors included in the discussion of the classroom environment appear to be equally applicable in science attitude.

Statistically significant differences appeared a number of times for both classroom environment and science attitude when using analysis of variance to compare mean scores of students of individual teachers. However, these differences appeared to reflect differences between individual teachers rather than other factors such as certification type.
Problem 3: What teaching characteristics do middle school science teachers rate as the most effective in creating a positive learning environment?

The single trait identified most frequently by participating teachers as important for teachers at the middle level was humor. This characteristic was identified by seven of the ten participating teachers. Humor was important as a means of defusing potential problems, making class more enjoyable for the students, and more interesting for the teacher. Nearly as frequently mentioned was knowledge of subject matter, identified by six of the ten participating teachers. When asked specifically about the importance of knowledge of subject matter all but one of the participating teachers thought it was moderately to very important. One exception was a teacher with secondary certification who thought that knowledge of subject matter was not important at all. Flexible, caring, and fair were also mentioned more than once. These characteristics should be included as important for teachers at any level, but the relative importance of each may vary between the middle level and other teaching levels. These characteristics are included in the list of characteristics identified by Buckner et al. (1991)
with the possible exception of caring which could be included with other traits listed by Buckner et al. such as accept students, warmth and kindliness, or willing to listen.

While humor was the trait most frequently mentioned by participating teachers none of the administrators spontaneously included this teaching trait. However, later when specifically asked about the role of humor in the classroom the administrators thought it was an important trait for middle level educators. Additionally, none of the administrators included knowledge of subject matter as one of the more important characteristics of an effective middle school teacher. When asked about the importance of knowledge of subject matter the administrators rated it moderately important to very important. In this respect they generally agreed with participating teachers. The administrator who rated knowledge of subject matter the highest had the building which tended to have primarily elementary certified teachers.

Administrators of buildings that were staffed primarily with secondary certified personnel appeared to have more concern with developing a student oriented approach while the other administrator appeared to have greater concern with subject
knowledge. This was particularly true in the areas of science and mathematics. Teachers, with one exception, appeared to place at least moderate importance on subject knowledge regardless of preparatory background. This suggests that administrators may perceive a difference between the two preparatory backgrounds based on subject knowledge or student centered teaching.

Problem 4: What differences in teaching behaviors exist between teachers with elementary and teachers with secondary preservice preparation?

Sub Problem A: What is the relationship between teaching behaviors and preservice background?

The stronger use of behaviors classed as personal by Buckner and Bickel (1991) by elementary certified teachers may reflect the greater emphasis on student centered instruction mentioned by McPartland (1990). If so, this appears to be one of the few areas of separation between teachers with the two types of certification. The personal characteristics tended to be those that required a higher degree of interaction at a more personal level than professional characteristics.

Although six of the ten participating teachers were part of a curriculum enhancement program, with one exception, no evidence of this was visible during
classroom observation periods. The relative age and experience level of the teachers may have made a change in teaching techniques difficult, or perhaps observations were made on days when innovative ideas were not being used in the classroom. In the sole exception one teacher was trying cooperative learning in several activities.

While reviewing the results of classroom observations it was noted that secondary certified teachers during the study period were more likely to do science activities in class than elementary certified teachers. During observation periods four secondary certified teachers used a total of six activities in teaching compared to one elementary certified teacher who used two activities during the observation periods. This may imply a lack of comfort with the science knowledge base by elementary teachers. Tobin et al. (1990) discussed some of the effects that a low knowledge base can have on teaching. They noted that even exemplary teachers used nonexemplary practices when teaching outside of their area of expertise. One participating administrator mentioned the low comfort level that many elementary certified teachers have with science.

During the study period the greater use of videotape by elementary certified teachers was noted.
There may be a relationship between this and a low comfort level in science. Using videotape resources does not require that the teacher have a large knowledge base. Videotape may be a way of bringing an expert on a subject into the classroom. Conversely, the single secondary certified teacher using videotape in the class specifically indicated that it allowed students a visual experience with the subject. The motivation for using video may be different depending on the knowledge base of the teacher, or the knowledge base may be irrelevant and teachers from both preservice backgrounds may use videos for the same reasons.

Sub Problem B: Are differences in teaching behaviors perceived to diminish with time?

Overall there was a perception by both teachers and administrators that teachers become better with experience. Seven of the participating teachers and all three participating administrators identified traits they believed teachers improved with experience. Druva et al. (1983) found a positive correlation between age of teacher and student outcomes (cognitive and affective). Their meta-analysis did not consider the variable of teacher experience level so it seems probable that experience level was reflected in the teachers of greater age.
This implies a merging of positive teaching characteristics with time. Additionally, it is possible that teachers without teaching behaviors appropriate for middle level education and unable to develop appropriate teaching behaviors may leave for elementary or high school, or leave teaching entirely. The largest perception of change through time in teaching behaviors was of greater flexibility on the part of more experienced teachers. The potential for stagnation was identified as a possible problem by several teachers. Administrator perceptions on this topic were similar to the teacher perceptions.

This study was exploratory in nature and was designed to help guide future research. While the small number of middle level teachers examined restricts generalizations from the data, the information has implications for guiding the direction of future research.

Summary

Participating teachers generally thought their preparatory backgrounds to be weak. The exception to this was in the science content area where typically science courses were perceived to be valuable.
Elementary certified teachers may desire a stronger science background. This may affect the types of activities elementary certified teachers use to teach science. Building administrators mentioned that elementary certified teachers frequently were not at ease with science. Generally, surveyed teachers agreed with McPartland (1990) that elementary teachers were more student oriented and secondary teachers were more subject oriented. The high level of experience of participating teachers may affect data by minimizing differences.

No significant differences were noted between classroom environment and attitude of students of teachers of the two certification types. Again, the high level of experience of participating teachers may affect data. The small sample size may mask differences that in a larger sample could show to be significant.

Teachers identified the use of humor most frequently as an important trait for middle school teachers. Other traits identified as important by teachers were knowledge of subject matter, flexible, caring, and fair. Administrators thought that humor was an important teaching characteristic along with knowledge of subject matter.

Elementary teachers were more likely to use
behaviors Buckner et al. (1991) classed as personal than did secondary certified teachers. However, both groups used personal behaviors with more frequency than professional behaviors. The overall feeling of participating teachers and administrators was that teachers become better with time. Both groups recognized that a few teachers may stagnate or "burnout." The improvement of teachers with time may imply a lessening of differences between the two types of certification with time.

In spite of recommendations for curriculum integration from sources such as Turning Points (1989) and AAAS (1989) and participation by six of the ten teachers in the curriculum enhancement project there was no evidence that this is happening in the contemporary classroom. In this respect both elementary and secondary prepared teachers were similar. One class was involved with several other classes in an awards ceremony, but otherwise there was no evidence of team teaching in any of the schools Other than the introduction of videocassette players and a few computers classrooms were similar to those of 20 or 30 years ago. The implication is that experienced teachers may be slow to accept new methods of teaching.
Recommendations

Interpretation of recommendations should be tempered by the realization that the number of subjects was small and not necessarily representative of all middle school science teachers. While the number of subjects was small, implications for future research areas remain valid.

For Future Research

The relationship of lesson types to the background of the teacher may be an unexpected variable. Classroom observations suggest that secondary science certified teachers use science activities more frequently than elementary certified teachers. Do science teachers with stronger science backgrounds tend to have lessons that are superior to teachers with a weak science background who have read the material prior to teaching the lesson? The results of this study suggest a need for research into this area.

Despite reports such as Science for All Americans and Turning Points as well as projects such as the Middle School Curriculum Enhancement Project
that point out the need for curricular integration and team approaches to teaching this does not appear to be happening. Merenbloom (1988) discusses the educational benefits of teaming at the middle level in helping create more effective schools. Research should focus on why curricular integration is not happening. Subsequent research in this area should investigate ways to facilitate teachers in using curricular integration.

Since many of the teaching characteristics identified by Buckner et al. (1991) are universal to teaching at all levels, are some of these characteristics more or less important at the middle level than they might be at the high school or elementary levels? There appears to be a need for research into the importance of different teaching behaviors that are most productive at given grade levels. What is the source of these teaching behaviors? Perhaps existing behaviors determine whether an elementary or secondary program is selected by a preservice teacher rather than those behaviors being developed by that program. Perhaps behaviors are acquired by modeling during field experiences rather than from course-work. Research is needed to identify factors leading to the development of teaching behaviors.
Is there a relationship between the number and type of science activities and the amount of science background of the teacher? Classroom observations indicate that science background may affect science teaching behaviors such as laboratory activities and restrict concrete learning experiences for the students if the teacher lacks basic science knowledge. Further research is needed to ascertain whether or not this relationship exists and if it does the strength of the relationship.

The administrators frequently focused on the “whole child” approach to teaching. They expressed the importance of this in middle school teaching. What is the relationship between knowledge of subject area and knowledge of the child? How are these best balanced at the middle level? A need exists to determine the importance of these two variables to teaching at the middle level and potential interactions between the two behaviors.

In this study there was a tendency for elementary certified teachers to use video resources more than secondary certified teachers. Was there a reason for this such as teacher uncertainty of subject matter and therefore a desire to bring a more knowledgeable individual? The use of video resources in the classroom both in terms of quantity and quality is an
area where more research is needed.

The difference in personal versus professional behaviors by teachers with different types of certification may be illuminating. This suggests an area that could benefit from future research. What is the relationship of these behaviors to student achievement?

How does experience impact on the teacher? Teacher and administrator perceptions imply that behaviors tend to merge with experience. Do teaching behaviors merge with time? To study the difference in certification types perhaps future research should focus on beginning teachers rather than experienced teachers.

**Implications for Certification**

Data from this study certainly suggest a need for child centered educators who are knowledgeable of their subject material. Current certification practices appear to produce child centered teachers who may be deficient in content knowledge or subject oriented teachers who may lack a child centered approach. Considering the amount of literature proclaiming the uniqueness of the middle level child, it appears ironic that the most liberal certification regulations are for teachers at the middle level.
Turning Points (1989) recommends that teachers for the middle grades be specifically prepared to teach at that level, stating that middle level education can be transformed by “developing expert teachers of young adolescents.” Data from this study suggests that separate certification should be established for middle level educators. This certification should be designed to provide a child centered approach, but have a strong base in all curricular areas. Turning Points recommends that middle level educators have a solid core of knowledge in one or more content areas and that teachers should work as members of a team. Training in skills required to be an effective team member should be considered to help achieve this. Logically each team would probably be composed of teachers with complementary specialty areas.
References


APPENDIX A

INTERVIEW GUIDE FOR TEACHER INTERVIEWS
Outline for Interview

(Introduction to tape: Name of teacher, date, school, subject)

Do you mind if I tape this session? If I tape, I do not need to rely on memory to record perceptions of this session.

Why did you decide to become a teacher?

When you decided to become a teacher what was your preferred grade level?

What reasons did you have for wanting that level?

If you did not plan to be a middle school teacher how did end up teaching middle school?

Looking back today, how would you rate your preservice preparation to be a science teacher?

Science methods courses vs. science content courses?

What about additional preparation for science teaching that you have taken since you started teaching?

What would you change about your preservice preparation for teaching middle school?

Generally, what types of disciplinary problems do you encounter and how do you handle them?

Is there any problem adapting the material to the students’ level?

Do your students seem to have a varied number of ability levels? How do you deal with this?

Take a minute to think about this.

1. What do you think makes an effective middle school teacher?

2. What five characteristics or traits you would rate as the most important for middle school teachers?
3. What makes an effective middle school science teacher?

How often do you find yourself wishing for a stronger science background?

How important do you find knowledge of subject material to be in teaching middle school science?

If you have taken extra hours in science do you think it helped make you a more effective teacher?

Do you wish you had received more training in teaching methods? Science teaching methods?

How would you describe your relationship with your students - realizing you probably only see them one period a day?

What percentage do you think they see you as a friend and what percentage as a teacher? (50% friend 50% teacher)

Do you use humor in your class? How?

How would you rate the role of teacher enthusiasm at the middle level?

Do you take advantage of unexpected events to augment your teaching?

How often do you ask questions of varying difficulty? (easy, moderate, or difficult)

How has your teaching has changed with experience?

How do you think teachers in general change with teaching experience?

What differences, if any, do you see between teachers with an elementary preservice background and teachers with a secondary science preservice background?

(Thank you for your time)
APPENDIX B

INTERVIEW GUIDE FOR ADMINISTRATOR INTERVIEWS
Outline for Interview

(Introduction to tape: Name of teacher, date, school, subject)

Do you mind if I tape this session? If I tape, I do not need to rely on memory to record perceptions of this session.

When you decided to become an administrator what was your preferred level?

What reasons did you have for wanting that level?

If you did not plan to be a middle school administrator how did end up in middle school?

What preparation did you have specifically for the middle level?

What would you change about your preparation for administrating in middle school?

What things do you do here that you would not do at the elementary or high school level? Given the opportunity what other things would you like to do?

How would you define "the middle school concept?"

How would you rate the preparation of your teachers for teaching at the middle level both in subject matter and the area of middle level education?

What do you perceive as necessary components of middle school teacher preparation?

In what ways do you like to see teachers handle discipline problems-punishments etc.

Take a minute to think about this.

1. What do you think makes an effective middle school teacher?

2. What five characteristics or traits you would rate as the most important for middle school teachers?
3. What makes an effective middle school science teacher?

How important do you find knowledge of subject material to be in teaching middle school science?

How do you see the role of humor in the classroom?

How would you rate the role of teacher enthusiasm at the middle level?

How do you think teachers in general change with teaching experience?

What differences, if any, do you see between teachers with an elementary preservice background and teachers with a secondary science preservice background?

What factors do you consider when hiring teachers? (education, certification, etc.)

Do you try to hire a teacher to fit a specific position (science, history etc.) or someone to fit generally into the middle school?

Do you consult with your staff on hiring decisions?

How many of the study teachers were hired with your involvement? Who?

(Thank you for your time)
APPENDIX C

CLASS OBSERVATION FORM
Teacher ____________________________ Date __________________
Times __________________

Personal Characteristics
Willing to listen

  Respectful toward students
  accept students

Enthusiastic

Optimistic

  warmth and kindliness

friendly

flexible

humorous

spontaneous

Professional Traits

Know subject

check to be sure all understand

  aware some students need extra help
  takes extra time for those who need it

well organized for class

makes sure students have success with new material

easy to understand

careful to correct students who don’t pay attention

use variety of materials and activities

compliment students for doing good job

ask easy average and difficult questions

Class activity during observation period
APPENDIX D

MY CLASS INVENTORY AND ANSWER FORM
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169-171, 173

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APPENDIX E

STUDENT ATTITUDE INSTRUMENT
APPENDIX F

FACTOR CORRELATION MATRIX FOR SCIENCE ATTITUDE
Factor Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
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<tr>
<td>Factor 3</td>
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</tbody>
</table>

Factor 1 = attitude toward science class
Factor 2 = value of science
Factor 3 = attitude toward science in society