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AN ANALYSIS OF TEACHERS' PERCEIVED BARRIERS TO METRIC CHANGE IN RELATION TO THEIR READINESS TO CHANGE

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By

Clifford Paul Weber

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ABSTRACT

AN ANALYSIS OF TEACHERS' PERCEIVED BARRIERS TO METRIC CHANGE IN RELATION TO THEIR READINESS TO CHANGE

By

Clifford Paul Weber

Statement of the Problem

This study is an attempt to investigate what teachers working in a selected school system and assigned to grades kindergarten through five judge to be the barriers to the implementation of the metric system, to determine the relationship between these barriers and the teacher's readiness to change, and to relate both the barriers and the readiness to change variables with selected demographic variables.

Procedure

The sample for this study consisted of 154 teachers from a large city school system in the State of Michigan. The participants were asked to react to two instruments. The first was the Readiness to Change Scale developed by Donald A. Trumbo in an unpublished doctoral dissertation, "An Analysis of Attitudes Toward Change Among the Employees of an Insurance Company," 1958, Michigan State University. The second was an instrument designed by the author to measure barriers to metric

change as perceived by the teacher. The statements used in this instrument were categorized into internal and external barriers to metric change. The internal barriers were considered to be those which the teacher perceived to be the result of inward stimulation. External barriers are those that the teacher perceived originating outside the self. The internal and external barriers, and the readiness to change variables were compared with the following demographic factors: age, sex, degree held, teaching experience, and participation in metric workshops, metric inservice, or metric seminars. The data obtained from the analysis of these variables were analyzed in terms of a Chi-square, Pearson Product-Moment Correlations, and independent t-test using a five percent (.05) level of significance as a limit.

Findings

The result of the statistical analysis produced the following findings:

1. Teachers who are more ready to change perceive fewer total barriers to metric change.
2. Teachers who are more ready to change perceive fewer internal barriers to metric change.
3. Teachers who are more ready to change perceive fewer external barriers to metric change.

4. Teacher's age has no relationship to readiness to change.
5. Teacher's age has no relationship to the number of perceived internal barriers to metric change.
6. Teacher's age has no relationship to the number of perceived external barriers to metric change.
7. Sex has no relationship to readiness to change.
8. Males perceived fewer internal barriers toward metric change.
9. Sex has no relationship to the number of perceived external barriers to metric change.
10. Professional education training has no relationship to readiness to change.
11. Professional education training has no relationship to the number of perceived internal barriers to metric change.
12. Professional education training has no relationship to the number of perceived external barriers to metric change.
13. Teaching experience has no relationship to readiness to change.
14. Teaching experience has no relationship to the number of perceived internal barriers to metric change.

15. Teaching experience has no relationship to the number of perceived external barriers to metric change.
16. Participation in metric workshops, metric inservice and metric seminars has no relationship to readiness to change at the .05 level of significance.
17. Teachers who have participated in metric workshops, metric inservice, or metric seminars perceive fewer internal barriers to metric change.
18. Teachers who have participated in metric workshops, metric inservice, or metric seminars perceive fewer external barriers to metric change.

ACKNOWLEDGMENTS

Without the assistance of many individuals this study would not have been possible. I should like to express my sincere thanks to the following people:

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TABLE OF CONTENTS

page

LIST OF TABLES

CHAPTER I

INTRODUCTION

In the last two decades, numerous research studies have been completed that relate to curriculum change which one would anticipate leading to curriculum improvement. Much of this research compares one method with another method in hopes of showing that one of the methods is superior. Many of the writings have been from the perspective of school administrators, curriculum consultants, university professors, doctoral students' dissertations, or representatives of textbook firms, and the results have been somewhat less than conclusive. One reason for the failure of a curriculum to produce the desired results, and one that is seldom considered in the ensuing evaluation process, has to do with the way the individual teacher perceives and reacts to the curriculum alteration. As K. T. Starkey reported in a study of the effects on teacher comments on attitude toward secondary mathematics class: "The effect of teacher attitude and behavior on student attitude varies greatly from teacher to teacher and particular teacher behaviors may also have

unanticipated effects on student attitudes."[1] Earlier studies of Fallager (1951),[2] Banning (1951),[3] Prewett (1956),[4] and Coy (1961)[5] illustrated that teacher attitude toward curriculum alteration and the degree to which the teacher is involved in the curriculum change has a definite effect on teacher's perceptions of the curriculum and to some degree determines how and what the teacher will eventually teach behind the closed door of the classroom.

Educators spend much time assessing and attempting to meet the individual needs of children. An equal amount of attention should be given to assessing and attempting to meet the individual needs of teachers. It is

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[1]K. T. Starkey, "The Effect of Teacher Comments on Attitude Toward and Achievement in Secondary Mathematics Classes: An Experimental Study" (Doctoral dissertation, Pennsylvania State University, 1970), Dissertation Abstracts International, 1971, 32, 259A-260A.

[2]William A. Fallager, "Some Teacher-Sensed Problems in Curriculum Improvement" (Doctoral dissertation, Columbia University, 1951).

[3]Evelyn L. Banning, "Teacher Attitude Toward Curriculum Change, A Study of the Junior High School Teachers of Pittsfield" (Doctoral dissertation, Harvard University, 1951).

[4]Clinton R. Prewett, "Let's Remove the Barriers to Good Teaching," The School Executive, LXXV - May, 1956, pp. 83-85.

[5]Donald Frederick Coy, "Selected Teachers' Expressed Judgments Concerning Barriers to Curriculum Improvement" (Doctoral dissertation, University of Florida, 1961), Dissertation Abstracts International, Ann Arbor, Michigan: University Microfilms, 1962, No. TSZ60-06, 663.

often the case that thirty teachers are provided with identical inservice instruction and are then sent into the classroom to produce "magical" results; yet in many schools teachers would not dare teach thirty children in a similar fashion. It is widely recognized that students have different needs, apprehensions, levels of achievement, and that they learn through various methods. It should also be recognized that teachers have different needs, apprehensions, fears, levels of achievement, and that they learn through various methods. As these different needs affect children's performance in the classroom, so do these different needs affect teachers' performance in the classroom.

Fallager (1951)[6] in a study of teacher-sensed problems to curriculum improvement classified needs, apprehensions, fears, and levels of achievement as barriers to change. He concluded that if those educators who are initiating change, revising curriculum, and providing workshops have an understanding as to what teachers perceive as being obstacles to curriculum change, and work closely with teachers, then many of the barriers can be swept away.

It is highly unlikely that all the individual teacher's fears or felt barriers to curriculum change can be swept away, but if those who are initiating

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[6]Fallager, p. 83.

change, revising curriculum and providing workshops have an understanding as to what the teacher perceives as being the obstacles to curriculum change, and if a sincere effort is made to reduce those barriers, then it follows that the proposed change to the metric system might stand a better chance of success. As Miel so forcefully stated:

> . . . curriculum change is something much more subtle than revising statements written down on paper. To change the curriculum of the school is to change the factors interacting to shape that curriculum. In each instance this means bringing about changes in people--in their desires, beliefs, and attitudes, in their knowledge and skill.[7]

All one has to do is talk with teachers about proposed curriculum changes and it soon becomes evident that teachers do perceive barriers to the change. Dempsey (1963),[8] in a study of barriers to curriculum change, pointed out that these barriers may be real or to some extent imaginary, but to the teacher these barriers are not only perceived as being real, but to some extent they influence the teacher's techniques, methods, content, and

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[7]Alice Miel, Changing the Curriculum: A Social Change Process (New York: Appleton-Century-Crofts, Inc., 1946), p. 10.

[8]Richard Allen Dempsey, "An Analysis of Teachers' Expressed Judgments of Barriers to Curriculum Change in Relation to the Factor of Individual Readiness to Change" (Doctoral dissertation, Michigan State University, 1963), Dissertation Abstracts International, XXIV, 3225.

most likely the level of achievement the students in the classroom attain. If the outsider sees these barriers as being imaginary or rationalizations, it is because the outsider fails to remember that teachers are human and in many cases wish to maintain the status quo and continue with those things they know best and those with which they feel comfortable. People often lack self-confidence and security in dealing with the unknown.

Dempsey classified the barriers to curriculum change into two categories: internal barriers and external barriers. For the purpose of this study, the teacher-perceived barriers to metric change will also be grouped into internal and external barriers. The internal barriers will be considered to be those which the teacher perceives to be the result of inner stimulation. Examples of internal barriers would be the teacher's perceived lack of ability to teach the metric system, fear of failure, lack of motivation, or the failure to recognize the importance of the metric system as a necessary part of the curriculum. On the other hand, external barriers would be those that the teacher perceives originating outside the self. Barriers imposed by lack of monies, materials, cooperation of other teachers, administrators and school policy will be considered examples of external barriers. Regardless of what the teacher perceives as barriers to curriculum change, and more specifically the

change to the metric system, it is necessary for those involved in teacher education to recognize these barriers. Fortified with this knowledge, the teacher educator can then construct and provide opportunities that will lead the teacher to develop the necessary skills, confidence, and knowledge to dispel or overcome these perceived barriers to teaching the metric system.

Significance of the Study

Today, as never before in our history, a heavy burden rests with those who call themselves educators. It is a burden composed of social, economic and political demands. Many of these demands are imposed by outside agencies with the assumption that schools can and will accept the demands and act accordingly. Educators have accepted these challenges and have developed curriculum programs designed to meet those needs.

One such challenge is the curriculum change to the metric system. The metric system is not new to the United States; in 1866 the metric system was made legal but not mandatory by the United States Congress. It was not until 1965, however, when the British announced their intention to convert to the metric system, that metric conversion received serious attention in the United States.[9]

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[9]"The Switch Is On . . . Conversion Continues to Build," American Metric Journal 4 (Unit 4, 1976): 133.

Three years later, in August 1968, the Secretary of Commerce was authorized to conduct a program of investigation, research and survey to determine the impact of increasing world-wide use of the metric system on the United States. The metric study concluded that it would be in the best interests of the nation to join the rest of the world in the use of the metric system. In addition, one of the two major activities that was to begin immediately, because of its pivotal nature, was in the area of education. The report noted:

> Every child should have the opportunity to become as conversant with the metric system as he is with our present system.[10]

As a direct result of the Secretary of Commerce efforts in the metric study Public Law 90-472 was enacted:

> On December 23, 1975, President Ford signed the Metric Conversion Act of 1975. The historic move placed the United States alongside 94% of the world's population who are either already on the metric system or converting to it. With the passage of the bill, metric system proponents gain essentially two things which previously they were without. These are federal sanction for the move to the International System of Units (SI), and a national metric board to coordinate the process. In the words of the Act, its purpose is: To declare a national policy of coordinating the increasing use of the metric system in the United States, and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system.[11]

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[10] Public Law 90-472, The U.S. Metric Study, Sec. 4, 11:18 (1968).

[11] Paul W. Merritt, "The Metric Conversion Act of 1975," Mathematics in Michigan, XV, March 1976, No. 4, p. 18.

Before the United States Congress and President Ford acted, the Michigan State Board of Education passed a resolution in September 1973, stating in part that all mathematics and science textbooks adopted after June 1976 should contain the metric system as the dominant system of measure.[12] In addition, Michigan completed a set of performance objectives in the metric system to be used in the Michigan Educational Assessment in 1976.[13] Various committees have been established to formulate guidelines, make recommendations, and establish inservice programs for educators in the field. To facilitate the inservice programs, the Michigan State Department of Education contracted for a statewide information user needs study. The results of this study showed that:

1. Classroom teachers most use proximate people for information sources.
2. The majority of decisions made by classroom teachers are in the areas of curriculum and instruction.
3. The information sources that the teachers would most like to see strengthened are the State Department of Education and the Regional Media Center/Intermediate School Districts.[14]

One aspect of the change process that may lead to the successful implementation of the metric system into the curriculum of the schools in Michigan has been

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[12]Ibid., p. 19.

[13]Ibid.

[14]John W. Porter to State Board of Education, Submission of Metric Education Proposal, 25 November 1975, (Mimeographed), p. 7.

neglected. This is the understanding of teachers, their values, attitudes, perceptions, beliefs, and readiness to change to the metric system.

This, then, is the significance of the study. By looking at one aspect of the total problem of metric implementation, it can be discerned what a selected group of teachers judge to be the barriers to metric change in relation to their readiness to change.

Purposes of the Study

1. To determine what teachers perceive as internal and external barriers to metric change.

2. To determine the varying degrees of readiness to change to the metric system of a selected sample of teachers.

3. To determine the relationship of selected demographic variables such as teaching experience, degrees held, age, sex, participation in metric inservice and workshops, to the teacher's attitudes toward metric change and to determine the degree to which these variables relate to the perceived barriers to metric change.

Statement of the Problem

This study will investigate what teachers working in a selected school system and assigned to grades kindergarten through five judge to be the barriers to the implementation of the metric system, and will determine the

relationship between these barriers and the teacher's readiness to change, and will relate both the barriers and the readiness to change variables with selected demographic variables.

Assumptions

Teachers sampled will evidence varying degrees of readiness to change.

Teachers sampled will perceive different obstacles as barriers to the implementation of the metric system in schools.

It is possible to construct a set of statements that will provide data on what teachers perceive as barriers to metric change.

Delimitations of the Study

The following may be considered as delimiting factors of which one should be aware.

1. The judgments and reactions of the teachers participating in the study to the instruments create natural limitations concerning the honesty of their judgments and reactions to the rather personally revealing nature of the questions.

2. An individual's readiness to change as measured at a particular point in time, rather than over a prolonged period using a pre-test and post-test method may be viewed as a limiting factor in the study.

3. Since the study is utilizing only one school district, to generalize beyond that one district is not possible. However, insights gained may prove advantageous to school systems of similar composition.

4. The study will be confined to grades kindergarten through five in a selected school district within the state of Michigan.

5. The study will not use all possible demographic data, but will confine the demographic data to those select items the researcher feels could most greatly effect the process of metric change.

Definition of Terms

1. Barriers: Everything that hinders or prevents a course of action corresponding to the forces at work in the field.[15]

2. Change: Any alteration in a structure, a process, or an event; or observed differences in a given perception of the passage of time.[16]

3. Metric System: Refers to the SI Metric System, the International System of Units as established

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[15]H. J. Eysenck and W. Arnold, Encyclopedia of Psychology, Vol. 1 (New York: Herder and Herder, 1972), p. 13.

[16]Horace B. and Ara Champney English, A Comprehensive Dictionary of Psychological and Psychoanalytical Terms (New York: Longman's, Green and Co., 1958), p. 83.

by the General Conference of Weights and Measures in 1960.[17]

4. Metric Change: The alteration from teaching the current English system of measurement to the SI Metric System.

5. Metric Education: The process of educating the teachers in the use of the SI Metric System.

6. Insecurity: An indefinite condition of feeling anxious, unsafe, threatened, or apprehensive.[18]

7. Security: A state in which satisfaction of needs and desires is guaranteed.[19]

8. Threat: An imagined event, believed likely to happen that excited dread.[20]

9. Frustration: The blocking of, or interference with, an ongoing goal-directed activity.[21]

10. Self-Concept: The totality of attitudes, judgments, and values of an individual relating to his behavior, abilities, and qualities.[22]

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[17]Public Law 90-472, 11:18.

[18]English, p. 264.

[19]Ibid., p. 483.

[20]Ibid., p. 554.

[21]Ibid., p. 217.

[22]Eysenck, p. 188.

11. External Barriers: Those hindrances or obstacles which the individual perceives as originating or being imposed from outside himself.

12. Internal Barriers: Those hindrances or obstacles which the individual perceives as originating or being imposed from within himself.

13. School Personnel as Barriers: Those obstacles that are perceived by the individual as originating from members of the school system or school staff, such as members of the board of education, superintendent, curriculum workers, principals, and other teachers.

14. Materials as Barriers: Those restrictions the individual perceives as being imposed by deficiencies or shortcomings in the quantity of teaching aids available for the teacher to use in instruction.

15. Time as a Barrier: Those barriers imposed by the lack of time (measurable duration).

Organization of the Dissertation

The intent of Chapter I has been to present an overview of the study through significance and purposes of the study, statement of the problem, related assumptions, delimitations, definition of terms and presentation of the organization of the dissertation.

Chapter II contains the review of related literature, and has two sections. The first section, Metrication in the United States, concentrates on available

literature justifying metric change, outlining problems encountered in metric change, and briefly discusses metric change procedures that have occurred in business. The second section, Teacher Attitude Toward Mathematics, surveys the research that relates a teacher's attitude toward the subject to a student's achievement in the subject, and reviews the rather limited research which relates directly to teacher attitude and barriers to metric change.

Chapter III is a discussion of the methods of data collection, population and sample, instrumentation, hypotheses, and statistical analysis. Chapter IV contains a report of the findings, and Chapter V presents a review of the findings, conclusions, and implications.

CHAPTER II

REVIEW OF RELATED LITERATURE

In reviewing the literature for this study, limited evidence was found of research directly related to teacher-perceived barriers to metric change. However, the studies identified two major areas of concentration. This chapter is divided into two sections, each section devoted to the literature of a particular area of concentration.

The first section, Metrication in the United States, concentrates on available literature justifying metric change, outlining problems encountered in metric change, and briefly discussing metric change procedures that have occurred in business. The second section, Teacher Attitude Toward Mathematics, surveys the research that relates a teacher's attitude toward the subject to a student's achievement in the subject, and reviews the rather limited amount of research which relates directly to teacher attitude and barriers to metric change in the public schools.

Metrication in the United States

Although this study is concerned with metric change as it relates to the teacher in the public school, a large number of articles on metrication have been written from the perspective of business which focus on justifying the change to metrics or on the transition process as metrics are already commonplace in some industries. Consumers already use 35-mm film, 100-watt bulbs, 120-volt irons, and metric tools for foreign cars.[23]

In the article, "Metrication Is Coming--Ready or Not," published in Chemical Engineering News, the transition processes of General Motors, Ford Motor Company, IBM Corporation and other smaller United States businesses are discussed.[24] General Motors adopted the metric system in 1974 and is in the process of converting their automobiles to metric measures. The Chevrolet Chevette is the first all-metric car built in America. By 1982 General Motors Corporation hopes to have completed total conversion from the customary English system to the metric SI system. Ford Motor Corporation has been making metric dimension engines since 1974 for its Pintos and Mustang II's. American Motors has initiated a policy requiring

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[23]Helen Lipscomb, "Russian Secret Weapon! A Positive Approach," American Metric Journal (September/October 1974): 41.

[24]Roy V. Hughson, "Metrication Is Coming--Ready or Not," Chemical Engineering News, October 29, 1973, pp. 64-66.

each corporate manager to acquaint themselves with metric conversion developments in the automobile industry so that they will be prepared to handle the changeover in their own field of expertise. Chrysler Corporation anticipates one hundred percent metric production in ten to fifteen years. However, Chrysler Corporation feels the transition period should be minimized to reduce costs.[25]

Other industries are requesting use of metric measurement. The Distilled Spirits Council of the United States has requested the Treasury Department to approve the adoption of six metric-sized bottles. The use of the new sizes would be mandatory by January 1, 1979.[26] Seven-Up was the first major producer of soft drinks in the U.S.A. to bottle former quart and pint sizes in liter and half-liter bottles. (To be correct, it should be liter and 500 milliliters.) The Coca-Cola Company has been selling their products by the milliliter and liter for years.[27]

Not all industries have voluntarily cooperated in the adoption of metrics. One such example was at the

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[25]"Time Schedule for Auto Makers, Conversion Well Under Way," American Metric Journal 4 (Unit 3, 1976): 131.

[26]"Food and Consumer Goods and Services," American Metric Journal 4 (Unit 3, 1976): 145.

[27]"Seven-Up Goes Metric," American Metric Journal (January/February 1975): 22.

1976 retailers' meeting where several individual firms declared they would not change their packaging from English to metrics until forced to do so.[28] Few retailers were willing to take the first step toward change, fearing that such risks, unless all retailers followed, would lose the company its share of the market.

However, many U.S. companies that depend on international trade may be forced to adopt the SI metric system if they are to maintain their share of the international market. R. W. Bemer details, in an article directed at manufacturers, the importance of designing products to the International System of Units. Products must be marked in metric units by 1978 to be certified by the European Economic Community (the Common Market) and the European Free Trade Area (associated member countries). After the first day of 1978 no products or literature will be approved for distribution in this market unless they follow the SI metric system.[29]

Many manufacturers indicate the main obstacle to change from English to metric is the cost. The cost of changing standards, retooling, and installing new machinery

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[28]"Meat-Advertising in Metric Units," American Metric Journal 4 (Unit 3, 1976): 146.

[29]R. W. Bemer, "European Market Prepares to Block All U.S. Made Goods," American Metric Journal (November/December 1974): 26.

that conforms to metric measures is expensive. Some major corporations are lobbying in Congress for some sort of tax relief assistance for the added costs of metric conversion. However, it appears that the legislature will not respond to these pressures, and the bulk of the metrication expenses will remain the corporation's responsibility. This is a deterrent to many small businesses and causes many of them to be anti-metric. Labor is also worried about the cost of metric change, particularly in the situations where workers own their own tools. The anti-metric sentiment in this segment of the general population could influence an anti-metric movement in homes across the country and slow support for the public schools' attempt to convert to the metric system as the sole unit of measure taught. As Jeffery V. Odom, Chief, Metric Information Office states:

> As industry changes over to metric, one basic principle is being followed and care should be exercised to see that it continues to be followed. We must insure we follow the rule of reason--this states that changes to metric should be made where it is advantageous to do so--no areas should change 'at any cost,' but neither should any area refrain from changing 'at any cost.'[30]

At the present time it seems that Mr. Odom's "rule of reason" has become stagnant. Except for multinational firms and a few industries selling overseas,

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[30]Jeffrey V. Odom, "Effects of Metrication on the U.S. Economy," American Metric Journal (September/October 1974): 14.

little progress has been made toward total implementation of the metric system in the U.S. This has tremendous impact on the education of youngsters in our schools. Mr. Art Frier, Superintendent of Math Supervisors, City of Los Angeles, points out:

> The real problem is what happens to the kindergarten through eighth grade youngsters who begin getting an education in metric units now and become young consumers along with those grade school kids who already make purchases in stores and are not in a position to make value comparisons. Without a knowledge of customary units, they won't be able to interpret quantity markings on the label. Without a knowledge of the inch/pound system they will be unable to read speed and distance signs on streets and highways, unless of course, there is a sudden conversion to metric.[31]

Nonetheless, many indicate that voluntary compliance to metrics is as effective as forced government action. In an article published in Research and Development (a summary of Donald Marlowe's testimony before the subcommittee on Science, Research and Development, which is part of the Committee on Science and Astronautics of Congress), the authors point out that metric use will continue to increase regardless of what action the United States government takes with respect to metric legislation. They also state that, discounting the advantages of the metric system, such as easier manipulating and recognizable "coherency" interrelationship between units,

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[31]Art Frier, "Schools Won't Change," American Metric Journal 4 (Unit 5, 1976): 239.

that the rest of the world is metric makes it necessary for the United States to convert to SI units.[32]

Teacher Attitude Toward Mathematics

When one considers the impact of the research concerning teacher attitude and student achievement, it is difficult to understand the lack of pre-metrication attitude surveys in the United States. The importance of such research has been clearly demonstrated by such notables as L. L. Thurstone and E. H. Chane (1941),[33] H. L. Billig (1944),[34] A. W. Bendig and J. H. Hughes (1954).[35] These are but a few who have shown the importance of attitude, both teacher and pupil, in relation to the achievement of students.

As an example of research bearing on this supposition, E. P. Torrance et al. (1966)[36] studied 127

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[32]"Metric SI," Research and Development, May 1973, p. 21.

[33]L. L. Thurston and E. H. Chane, The Measurement of Attitude (Chicago: University of Chicago Press, 1941).

[34]H. L. Billig, "Student Attitude as a Factor in the Mastery of Commercial Arithmetic," The Mathematics Teacher, April 1944, pp. 170-172.

[35]A. W. Bendig and J. H. Hughes, "Student Attitude and Achievement in a Course in Introductory Statistics," Journal of Educational Psychology (October 1954): 268-276.

[36]E. P. Torrance et al., "Characteristics of Mathematics Teachers That Affect Students' Learning," Report No. CRP-1020, 1966, University of Minnesota, Contract No. OEC-SAE8993, U.S. Office of Education.

sixth through twelfth grade mathematics teachers who participated in an experimental program to evaluate School Mathematics Study Group instructional materials. The result was that teacher effectiveness had a positive effect on student attitudes toward teachers, methods, and overall school climate.

Garner (1963)[37] administered an inventory concerning attitudes toward algebra to first-year algebra teachers and their pupils. Significant relations were found between: (1) teachers' background in mathematics and students' achievement in algebra; (2) teachers' attitude toward algebra and students' attitudes; (3) teachers' and students' judgments concerning the practical value of algebra.

Peskin (1965)[38] studied the relationship of teacher attitude and understanding of seventh-grade mathematics to the attitudes and understanding of students in nine New York City junior high schools. Positive correlations were shown between teachers' and students'

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[37]M. V. Garner, "A Study of the Educational Background and Attitudes of Teachers Toward Algebra as Related to the Attitudes and Achievements of Their Anglo-American and Latin-American Pupils in First-Year Algebra Classes of Texas" (Doctoral dissertation, North Texas State University, 1963), Ann Arbor, Michigan: University Microfilms, 1966, No. 66-3923.

[38]A. S. Peskin, "Teacher Understanding and Attitude and Student Achievement and Attitude in Seventh Grade Mathematics" (Doctoral dissertation, New York University, 1964), Ann Arbor, Michigan: University Microfilms, 1965, No. 65-6584.

understandings of algebra and geometry and between teachers' understanding scores and students' attitudes.

In the last five years many studies of teachers and their attitudes toward mathematics have used prospective teachers. This research has taken place primarily because student teachers are a convenient group from which to draw research samples and the attitudes of this group are especially important because of their potential influence on pupils. Some of these studies compared an experimental approach to a more traditional approach to mathematics. Collier (1969)[39] had results that showed attitudes in formal and informal approaches to be approximately linear except in low achievers. Students who planned to teach in grades K-2 had more formal views of mathematics education than did students who planned to teach the higher grades. Erickson (1970),[40] in a study to determine if attitudes and achievement of prospective teachers could be improved by completing a two-quartered mathematics sequence

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[39]C. P. Collier, "The Formal-Informal Dimensions of Attitude Toward Mathematics and Mathematics Instruction of Prospective Elementary Teachers" (Doctoral dissertation, University of Wisconsin, 1969), Dissertation Abstracts International, 1970, 31, 660A-661A.

[40]B. L. Erickson, "Effects of a College Mathematics Sequence Upon the Attitudes and Achievement in Mathematics of Prospective Elementary School Teachers" (Doctoral dissertation, Utah State University, 1970), Dissertation Abstracts International, 1970, 30, 5537A.

designed for elementary school teachers, reported results that were statistically significant in linking attitude to achievement.

Singleton (1971),[41] in an evaluation of a 32-hour inservice teachers' training program in modern mathematics obtained results that showed pupils' gain in achievement in arithmetic concepts is greater when taught by teachers who participated in the inservice. Flexer (1973),[42] in a comparison of lecture and laboratory methods in mathematics for elementary teachers, indicated in her results that there was no significant difference in achievement between the lecture and laboratory groups. However, faculty and students agreed that the laboratory approach was valuable and facilitated the understanding of certain mathematical concepts. Other studies compared experimental approaches to traditional approaches with similar consistent results. This is true whether the traditional, one-teacher approach is compared with the enrichment

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[41] D. C. Singleton, "The Impact of an Inservice Training Program in Modern Mathematics on Teachers' Attitude Toward Mathematics and Pupils' Performance on Standardized Tests" (Doctoral dissertation, Duke University, 1971), Dissertation Abstracts International, 1972, 32, 5661A.

[42] R. J. L. Flexer, "A Comparison of Lecture and Laboratory Methods in a Mathematics Course for Prospective Elementary Teachers" (Doctoral dissertation, University of Colorado, 1973), Dissertation Abstracts International, 1974, 34, 6496A.

(Wardrop, 1972);[43] programmed (Beattie, 1970)[44]; Drum, 1974)[45]; individualized (Kontogianes, 1974);[46] micro-teaching (Kilman, 1971);[47] in-context (McNerney, 1969);[48] or two-teacher (Williams, 1971)[49] approaches to

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[43]R. F. Wardrop, "Effect of Geometric Enrichment Exercises on the Attitudes Toward Mathematics of Prospective Elementary Teachers," School Science and Mathematics 72 (1972): 794-800.

[44]I. D. Beattie, "The Effects of Supplementary Programmed Instruction in Mathematics on the Mathematical Attitudes and Abilities of Prospective Teachers" (Doctoral dissertation, Southern Illinois University, 1969) Dissertation Abstracts International, 1970, 30, 3343A.

[45]R. L. Drum, "The Effects of Supplementary Programmed Instruction on the Mathematical Understanding and Attitude Toward Mathematical Understanding and Attitude Toward Mathematics of Prospective Elementary School Teachers" (Doctoral dissertation, East Texas State University, 1973), Dissertation Abstracts International, 1974, 34, 7083A-7084A.

[46]J. T. Kontogianes, "The Effects on Achievement, Retention, and Attitude of an Individualized Instructional Program in Mathematics for Prospective Elementary School Teachers" (Doctoral dissertation, University of Oklahoma, 1973), Dissertation Abstracts International, 1974, 34, 5802A.

[47]D. C. Kilman, "The Effect of Micro-Teaching Technique on the Attitudes of Prospective Elementary Teachers Toward Mathematics" (Doctoral dissertation, Oklahoma State University, 1969), Dissertation Abstracts International, 1969, 30, 2885A.

[48]C. R. McNerney, "Effects of Relevancy of Content on Attitudes Toward, and Achievement in, Mathematics by Prospective Elementary School Teachers" (Doctoral dissertation, Ohio State University, 1969), Dissertation Abstracts International, 1969, 30, 2885A.

[49]B. G. Williams, An Evaluation of a Continuous Progress Plan in Reading and Mathematics on the Achievement and Attitude of Fourth, Fifth, and Sixth Grade Pupils" (Doctoral dissertation, Lehigh University, 1973), Dissertation Abstracts International, 1974), 34, 7115A-7116A.

instruction. A strong impression emerging from these studies is that experimental methods of teaching mathematics are not superior to traditional methods with respect toward changes in attitudes toward the subject matter.

As attitude has an effect on teacher achievement in mathematics, so does student attitude have an effect on student achievement in mathematics.

A study by Bassham, Murphy, and Murphy (1964)[50] showed that even with individual differences in mental ability and reading comprehension held constant, a significant relationship existed between pupil attitude toward arithmetic and pupil achievement in arithmetic. In another study, Frank Smith (1964),[51] upon administering an attitude scale developed by Wilbur Dutton to a group of prospective teachers, found that too many prospective teachers have negative attitudes toward arithmetic. His research also indicated that more than one-half of the teachers in his study named the elementary years as that period in which their feelings toward arithmetic developed.

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[50]Harrel Bassham, Michael Murphy and Katherine Murphy, "Attitudes and Achievement in Arithmetic," The Arithmetic Teacher, February 1964, p. 121.

[51]Frank Smith, "Prospective Teachers' Attitudes Toward Arithmetic," The Arithmetic Teacher, November 1964, pp. 474-477.

Robert Kane's article "Attitudes of Prospective Elementary School Teachers Toward Mathematics and Three Other Subject Areas," surveyed elementary teachers' attitudes. He found that mathematics and English (language arts) consistently commanded more positive attitudes than social studies and science when the total group of teachers, kindergarten through six was considered. Teachers at grade levels four through six rated mathematics most often as their favorite subject to teach. He concluded that prospective teachers who have relatively unfavorable attitudes toward mathematics tend to prefer teaching assignments in the primary grades, while those who have the most favorable attitudes toward mathematics tend to prefer assignments in the intermediate grades.[52]

Research does not consistently show a positive correlation between teachers' attitudes and students' attitudes. Wess (1969),[53] in a study to determine whether teachers' attitudes had any significant effect on students' attitudes and achievement in mathematics,

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[52]Robert B. Kane, "Attitudes of Prospective Elementary School Teachers Toward Mathematics and Three Other Subject Areas," The Arithmetic Teacher, February 1968, pp. 195-199.

[53]R. G. Wess, "An Analysis of the Relationship of Teachers' Attitudes as Compared to Pupils' Attitudes and Achievement in Mathematics" (Doctoral dissertation, University of South Dakota, 1969), Dissertation Abstracts International, 1970, 30, 3844A-3845A.

indicated that there were no significant relationships between teachers' attitudes toward mathematics, pupils, reading, or social studies and pupils' attitudes toward mathematics, school reading, or social studies. There was also no significant relationship between teachers' attitudes toward mathematics and pupils' attitude or achievement in mathematics. Caezza (1969)[54] reported in a study designed to measure teacher attitude toward mathematics, teacher knowledge of elementary school mathematics, pupil attitude toward mathematics, and pupil achievement in elementary school mathematics, that pupil gain in achievement did not appear affected by teacher knowledge of mathematical concepts. Correlations between pupil achievement and teacher or pupil attitude were not considered significant. Von de Walle (1972),[55] in a study to determine the relationship of teachers' perceptions of and attitudes toward mathematics to student computational ability and comprehension of mathematical

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[54]J. F. Caezza, "A Study of Teacher Experience, Knowledge of and Attitude Toward Mathematics and the Relationship of These Variables to Elementary School Pupils' Attitudes Toward and Achievement in Mathematics" (Doctoral dissertation, Syracuse University, 1969), Dissertation Abstracts International, 1970, 31, 921A-922A.

[55]J. A. Von de Walle, "Attitudes and Perceptions of Elementary Mathematics Possessed by Third and Sixth Grade Teachers as Related to Student Attitude and Achievement in Mathematics" (Doctoral dissertation, Ohio State University, 1972), Dissertation Abstracts International, 1973, 33, 4254A-4255A.

concepts and attitudes, found that teachers with informal perceptions (those that view mathematics as a subject which is probing and creative) coupled with positive attitudes, were associated with student comprehension of mathematical concepts. On the other hand, a negative teacher attitude with an informal perception was associated with student computational ability. No significant cause and effect relationships were indicated.

Assuming that teacher attitudes can be communicated to students and can affect the attitudes and performance of students, it might be desirable to know what percentage of elementary teachers like or dislike arithmetic and what their reasons are. In one such study Stright (1960)[56] concluded that a large percentage of elementary teachers enjoy teaching arithmetic and try to make it interesting. Dutton (1962)[57] found that 38 percent of 127 elementary education majors had unfavorable attitudes toward arithmetic. Reys and Delon (1968)[58] reported that only about 60 percent of the 385 University

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[56]V. M. Stright, "A Study of the Attitudes Toward Arithmetic of Students and Teachers in the Third, Fourth, and Sixth Grades," Arithmetic Teacher, 1960, 7, pp. 280-286.

[57]W. H. Dutton, "Attitude Change of Prospective Elementary School Teachers Toward Arithmetic," Arithmetic Teacher, 1962, 9, pp. 418-424.

[58]R. E. Reys and F. G. Delon, "Attitudes of Prospective Elementary School Teachers Toward Arithmetic, The Arithmetic Teacher, 15, 1968, pp. 363-366.

of Missouri education majors whom they surveyed had favorable attitudes toward arithmetic. In Smith's (1964)[59] and White's (1964)[60] studies, reasons for disliking arithmetic were quite similar: word problems, boring work, long problems, and lack of understanding, lack of teacher enthusiasm, fear of arithmetic, difficulty with specific skills such as division, fractions, square roots, and percentages. The researcher estimates that these studies represent the reactions of approximately one-third of prospective elementary school teachers.

Although it is certainly unfair to indict teachers too strongly as creators of negative student attitudes toward mathematics, the results of research indicate that the teacher, perhaps even more than the parent, is an important determiner of student attitudes. Banks (1964) wrote:

> An unhealthy attitude toward arithmetic may result from a number of causes. Parental attitude may be responsible. . . . Repeated failure is almost certain to produce a bad emotional reaction to the study of arithmetic.

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[59] F. Smith, "Prospective Teachers' Attitudes Toward Arithmetic," The Arithmetic Teacher, 1964, 11, pp. 474-477.

[60] M. J. A. White, "A Study of the Change of Achievement and Attitude Toward Arithmetic by Prospective Elementary School Teachers Under the Conditions of Television" (Doctoral dissertation, Wayne State University, 1963), Ann Arbor, Michigan: University Microfilms, 1964, No. 64-5114.

> Attitude of his peers will have its effect upon the child's attitude. But by far the most significant contributing factor is the attitude of the teacher. The teacher who feels insecure, who dreads and dislikes the subject, for whom arithmetic is largely rote manipulation, devoid of understanding, cannot avoid transmitting his feelings to the children. . . . On the other hand, the teacher who has confidence, understanding, interest, and enthusiasm for arithmetic has gone a long way toward insuring success.[61]

There is some indication that sex plays a role in both attitude and achievement in mathematics. Hilton and Berglund (1974),[62] in a longitudinal study designed to predict preadolescent sex differences in both attitude and achievement in mathematics, and to determine if this sex difference widens with age, found that differences in math achievement and attitudes between males and females does take place in concert with increasing differences in interest and age. The January 1975 report, Math Fundamentals: Selected Results from the First National Assessment of Mathematics, shows the following:

> Neither sex has a clear advantage in computational ability since results for males and females varied at the different age levels.

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[61] J. H. Banks, Learning and Teaching Arithmetic, 2nd ed. (Boston: Allyn & Bacon, 1964), pp. 16-17.

[62] T. L. Hilton and G. W. Berglund, "Sex Differences in Mathematics Achievement: A Longitudinal Study," Journal of Educational Research 67 (1974): 231-237.

> Male and female overall performance differed by only 1 percentage point at ages 9 and 17; girls had approximately a 3 percentage point advantage at age 13, while for adults, males outperformed females by about 4 percentage points.[63]

Keeves (1973),[64] in a study to correlate sexes of students with interest in mathematics and science, found differences in achievement between boys and girls were greater at the pre-university level than at age prior to the end of compulsory schooling. Accompanying these differences in achievement were distinct sex differences in interest and attitude to mathematics and science. Nevin (1973)[65] discovered in a study looking at participation rates of both sexes in mathematics and science courses at Irish schools, that Irish girls participate in mathematics and science courses much less than Irish boys at the university level. He attributes this to the deep interest most Irish girls have in human relationships, and that this interest may be a barrier

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[63] Math Fundamentals: Selected Results from the First National Assessment of Mathematics, Mathematics Report No. 04-MA-01 (Washington, D.C.: Government Printing Office, 1975), p. 35.

[64] J. P. Keeves, "Differences Between the Sexes in Mathematics and Science Courses," International Review of Education 19 (1973): 47-63.

[65] M. Nevin, "Sex Differences in Participation Rates in Mathematics and Science at Irish Schools and Universities," International Review of Education 19 (1973): 88-91.

to an interest in such abstract subjects as science and mathematics. Simpson (1973),[66] in a study designed to compare the effects of a laboratory-oriented program in mathematics and a traditional teacher-centered program in mathematics upon the attitudes and achievement of seventh grade students who had been identified as slow learners, found males to have a more positive attitude toward mathematics, while females had a more positive attitude toward school and school learning in general.

All studies have not been conclusive concerning sex differences. Jacobs (1974),[67] in a study designed to isolate two factors, attitude toward mathematics, and the level of sex role stereotyping, and the relationship these have on achievement in mathematics, found at the seventh and eleventh grades no significant differences between the sexes with regard to attitude toward mathematics or achievement in mathematics. Keller

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[66]C. J. Simpson, "The Effects of Laboratory Instruction on the Achievement and Attitudes of Slow Learners in Mathematics" (Doctoral dissertation, Lehigh University, 1973), Dissertation Abstracts International, 1974, 34, 6959A-6960A.

[67]J. E. Jacobs, "A Comparison of the Relationships Between the Level of Acceptance of Sex-Role Stereotyping and Achievement and Attitudes Toward Mathematics of Seventh Graders and Eleventh Graders in a Suburban Metropolitan New York Community" (Doctoral dissertation, New York University, 1974), Dissertation Abstracts International, 1974, 34, 7585A.

(1974),[68] in looking at outcomes in mathematics in the affective and cognitive areas of ninth grade level students, found no statistically significant differences due to sex with respect to attitudes toward mathematics at $p < .01$ or $p < .05$ level and no statistically significant differences due to sex with respect to achievement toward mathematics at $p < .01$ or $p < .05$ level. Boys and girls seem to be evidencing the same achievement and attitude patterns toward mathematics. McClure (1970),[69] in a study measuring an individual's attitude toward mathematics, found no significant difference between attitudes of males and females toward elementary school mathematics.

Maccoby may have the best explanation for sex differences in achievement as well as the simplest:

> Members of each sex are encouraged in, and become interested in and proficient at, the kinds of tasks that are most relevant to the roles they fill currently or are expected to fill in the future. According to this view, boys in high school forge ahead in math because they and their parents and teachers know they

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[68] C. M. Keller, "Sex Differentiated Attitudes Toward Math and Sex Differentiated Achievement in Math on the Ninth Grade Level in Eight Schools in New Jersey" (Doctoral dissertation, The State University of New Jersey, 1974), Dissertation Abstracts International, 1974, 35, 3300A.

[69] W. C. McClure, "A Multivariate Inventory of Attitudes Toward Selected Components of Elementary School Mathematics" (Doctoral dissertation, University of Virginia, 1970), Dissertation Abstracts International, 1971, 31, 5941A-5942A.

> may become engineers or scientists; while the girls know they are unlikely to need math in the occupations they will take up when they leave school.[70]

The literature which relates directly to teacher attitude and barriers to metric change is extremely limited. However, a study by Trent (1975),[71] which details whether or not teachers have the ability to be able to measure and think metrically, had findings which showed:

a. A high percentage of Nevada elementary teachers had not had a course in which the metric system was taught or used.

b. Teachers do not feel qualified to teach arithmetic or science courses in which the metric system is used or taught.

c. Teachers do not feel their students are adequately prepared in the metric system.

d. Teachers do not feel adequate guidelines, course outlines and materials on the metric system are available to them for satisfactorily teaching the metric system to their students.

e. The elementary teachers were unable to respond correctly to questions relating to meters, kilograms, and liters.

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[70] E. E. Maccoby, ed., The Development of Sex Differences (Stanford: Stanford University Press, 1966), p. 40.

[71] John H. Trent, "Comparative Needs of Elementary and Secondary Inservice Teachers and College Pre-Service Students for Metric Education" (ERIC, ED115480, 1975).

Carol McGill (1974),[72] in a study designed to assess the needs of elementary teachers with respect to metrication and their cognitive and affective knowledge, discovered that the average elementary teacher can be described as having neutral attitudes toward metrication--neither positive nor negative. Furthermore, most teachers missed enough basic concepts in metrics to conclude that metric inservice is necessary. There was no significant difference in either attitude or knowledge scores of teachers in a rural, urban, or suburban setting. There also was no significant difference in either the attitude or knowledge scores of primary grade teachers (first, second, or third) or intermediate grade teachers (fourth, fifth, or sixth). McGill also determined that age, sex, degree level, year degree was received, grade level taught, and years of teaching experience, had little if any influence in determining either a teacher's attitude toward metrication or a teacher's knowledge concerning the metric system.

Summary

In this chapter an attempt has been made to present findings of selected related literature. This

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[72]Carol McGill, "A Study of the Needs of Teachers Involved in the Transitional Program from English to Metric System in the Elementary Schools" (Doctoral dissertation, University of Houston, 1974), Ann Arbor, Michigan: University Microfilms, 1975, No. 75-1016.

literature represents the two major concerns of this project. The first concern deals with metrication in the United States. It would seem from the literature reported that gains are being made in the change from the English system to the metric SI system. It would also seem that this gain is taking place slowly with indications of considerable opposition to the change from the industrial and marketing complex of this country. This opposition, if allowed to continue, could have tremendous impact on the public schools' attempt to convert to metrics as the sole system of measurement taught. The second concern of this chapter was the research that relates a teacher's attitude toward mathematics to a student's attitude and achievement in mathematics. The most salient feature of research on attitudes toward mathematics conducted in the last decade is its sheer volume. The major topics covered were: the distribution and stability of mathematics attitudes; the effects of attitudes on achievement in mathematics; the relationship of mathematics attitudes and achievement to sex, and to teacher characteristics, attitudes, and behaviors. Also covered was the rather limited research on teacher attitude and achievement in the metric system.

Perhaps the soundest conclusion that can be drawn from the results of the studies cited in this

chapter is that changes in attitude toward mathematics involve complex interactions among student and teacher characteristics, methods of instruction, parental and peer support, as well as the models of cultural sex-role stereotypes.

CHAPTER III

METHODS, DESIGN, PROCEDURES

This study is primarily concerned with assessing the barriers to metric change as perceived by the teacher, determining the teacher's readiness to change, and the relationship of selected demographic variables to the teacher's attitudes toward metric change.

In this chapter, a discussion is made of the full procedures of this study. The collection of data is explained, the sample is identified, and the research hypothesis, description of instruments used, statistical procedures, and pilot study are discussed.

Collection of the Data

The initial step was to identify those school districts in the state of Michigan large enough to provide significant participants to adequately carry out the study. Only school districts with one hundred or more teachers in grades kindergarten through five were considered. This limited the considered population to large metropolitan school districts. Letters were mailed to several school district superintendents to request

cooperation in the project. From the respondents, one school district was chosen because the superintendent seemed most cooperative and in conversations with the researcher indicated that the teachers in grades kindergarten through five represented a cross-section of teachers with varied backgrounds and experience. In addition, the school district chosen was close to the researcher's residence.

After the initial contact was made and permission secured, the superintendent assigned to the researcher the director of elementary curriculum who reviewed the proposed study and made suggestions to facilitate the collection of the data.

The final step in securing the participants was to meet with the elementary school principals to discuss the proposed study and solicit their cooperation. A meeting was arranged by the director of elementary curriculum and the reactions were generally positive, as all principals agreed to participate, although some were at first reluctant because they felt the opening of school was too hectic to devote some of the time to this research. Discussion at the meeting centered around the nature and scope of the study, as well as the function and use of the instruments. At the end of the meeting agreement was reached on the procedures: (1) a letter was to be written by the researcher to be included in

each principal's newsletter to the teachers explaining the study, their rights under the master agreement between the board of education and the teachers' union, and to solicit their cooperation; (2) each school would be provided with an abstract of the finished project; (3) the questionnaires were to be administered during the first fifteen minutes of the next regular staff meeting of each of the elementary schools; and (4) the questionnaires were to be returned within two weeks via the United States mail.

It should be noted that just prior to the administering of the questionnaires, the school district had undergone several millage failures, resulting in considerable reduction of administration and staff. This concerned the researcher in that the possibility of low morale or dissatisfaction with the job could influence the responses on the questionnaire. This was briefly discussed with the elementary principals at the meeting and they assured me that teacher morale was high and that teachers were anxious to get the school year in full operation.

Population and Sample

The population for this study consists of 160 elementary teachers in grades kindergarten through five in the thirteen elementary schools in the Jackson Public

School District. Only full time equivalent classroom teachers are included in the population, thus eliminating physical education, art, vocal and instrumental music teachers, speech correctionists, and other special teachers periodically assuming teaching roles in the elementary schools.

The sample consists of 154 of 160 teachers in the Jackson elementary schools. Participation in the study was voluntary in accordance with the master agreement between the teachers' union and the board of education.

Six teachers elected not to participate in the study and no information is known about them. Table 3.1 provides the reader with a more detailed insight into the demographic variables of age, sex, and teaching level of the 154 classroom teachers who make up the sample. Table 3.2 details the demographic variables of highest degree, experience, and participation in metric workshops, metric inservice, or metric seminars. The reader should note that some participants did not respond to all questions.

Research Hypotheses

In this chapter the hypotheses are stated as research hypotheses. In chapter IV the hypotheses are stated in null form for the sake of research continuity.

TABLE 3.1

CHARACTERISTICS OF THE SAMPLE:
AGE, SEX, AND TEACHING LEVEL

Characteristic	Frequency Observed	Percentage Observed
Age		
20-24	2	1.3
25-29	15	9.9
30-34	24	15.8
35-39	20	13.2
40-44	17	11.2
45-49	28	18.4
50-54	19	12.5
55-59	16	10.5
60 or more	11	7.2
TOTAL	152	100.0
Failed to report	2	.013
Sex		
Male	20	13.1
Female	133	86.9
TOTAL	153	100.0
Failed to report	1	.006
Teaching Level		
K	12	7.8
1	29	19.0
2	27	17.6
3	27	17.6
4	25	16.3
5	21	13.7
Other	12	7.8
TOTAL	153	100.0
Failed to report	1	.006

TABLE 3.2

CHARACTERISTICS OF THE SAMPLE: HIGHEST DEGREE HELD, EXPERIENCE, AND PARTICIPATION IN METRIC WORKSHOP, METRIC INSERVICE, OR METRIC SEMINAR

Characteristic	Frequency Observed	Percentage Observed
Degree Held		
Bachelor's	77	50.3
Master's	76	49.7
Doctorate	--	----
TOTAL	153	100.0
Failed to report	1	.006
Experience		
Less than one year	1	.7
One	1	.7
Two	1	.7
Three	2	1.3
Four	5	3.3
Five to nine	36	23.5
Ten to fourteen	31	20.3
Fifteen to nineteen	30	19.6
Twenty or more	46	30.1
TOTAL	153	100.0
Failed to report	1	.006
Participation in Metric Workshop, Metric Inservice, or Metric Seminar		
Yes	82	53.6
No	71	46.4
TOTAL	153	100.0
Failed to report	1	.006

I. Teachers who are more ready to change will perceive fewer total barriers to metric change than teachers who are less ready to change.

Ia. Teachers who are more ready to change will perceive fewer internal barriers to metric change than teachers who are less ready to change.

Ib. Teachers who are more ready to change will perceive fewer external barriers to metric change than teachers who are less ready to change.

Ic. Teachers who are more ready to change will perceive more internal barriers to metric change than external barriers to metric change.

Hypothesis I is based on the assumption that those teachers who perceive change as a threat to the somewhat stable environment in which they work may see multiple reasons which prohibit them from accepting the proposed change as a positive element in their continual strive for excellence. The degree to which the individual perceives this change as a threat may indicate the magnitude of excuses the individual employs in an effort to protect himself/herself. On the other hand, those individuals who perceive the proposed change as a positive element may behave in a manner which indicates they

perceive few barriers to the proposed change. This may reflect on the individual's ability to cope with change or on the individual's ability to deal effectively with change.

Hypotheses Ia, Ib, and Ic are based on the assumption that teacher-perceived barriers are directly related to teacher attitudes; those individuals who have an unfavorable attitude toward mathematics may have a high anxiety level toward metric change. Unless individuals perceive a need to change, they are unlikely to perceive themselves as an integral component of the change process. This perceived need and how it may affect individuals will be a significant contributor toward their response to the proposed change. As individuals proceed toward the proposed change, they may overcome many of the barriers that they perceive blocking the road to success. As these barriers are destroyed, new barriers, whether real or imagined, begin to occupy the position of the destroyed barriers. The external barriers are generally the easiest to overcome as they are more easily perceived. The less likely perceived barriers are those classified as internal and are more difficult to overcome as many are unconsciously held and take the form of attitudes, beliefs and values that have been formed over a period of time. To overcome these internal barriers requires considerable insight

and strength into one's self as these barriers form the base of one's personality. This process may at times be difficult and distasteful, yet when undertaken it can yield rewards in the form of recognition of the self as an integral part of the change process.

Secondary Hypotheses Relating to Demographic Variables

A. Age

1. Younger teachers will be more ready to change than older teachers.
2. Younger teachers will perceive fewer internal barriers to metric change than older teachers.
3. Younger teachers will perceive fewer external barriers to metric change than older teachers.

It is generally believed that the older the teacher's age, the more rigid they have become in their teaching methods and less ready to adopt new methods. The cause of this rigidity would be based on certain teaching procedures the teacher has developed, found successful and comfortable over the years. On the other hand, younger teachers probably would not yet have had the opportunity to entrench these procedures firmly in their teaching style and consequently would be more ready to change.

B. Sex

1. Male teachers will be more ready to change than female teachers.
2. Male teachers will perceive fewer internal barriers to metric change than female teachers.
3. Male teachers will perceive fewer external barriers to metric change than female teachers.

There is some evidence that due to lack of motivation, interest, and confidence, females tend to shy away from mathematically oriented disciplines.[73] In the past the male has dominated the science disciplines such as mathematics, physics, chemistry and the biological sciences. Given this evidence, males may be more able to cope with barriers to metric change, especially those of an internal nature.

C. Degree Held

1. Teachers with more professional education training will be more ready to change than teachers with less professional education training.
2. Teachers with more professional education training will perceive more internal

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[73]Eleanor E. Maccoby and Carol N. Jacklin, The Psychology of Sex Differences, pp. 119-120.

barriers to metric change than teachers with less professional education training.

3. Teachers with more professional education training will perceive more external barriers to metric change than teachers with less professional education training.

The rationale considered in these hypotheses is that people who have returned for graduate study have been exposed to more educational trends and ideas and therefore are more likely to be ready to change to the metric system. However, those who have returned for graduate study are more likely to be aware and sensitive to the potential barriers to metric change, and might be more aware of their limitations in overcoming those barriers of an internal nature.

D. Teaching Experience

1. Teachers with more teaching experience will be less ready to change than teachers with less teaching experience.
2. Teachers with more teaching experience will perceive more internal barriers to metric change than teachers with less teaching experience.

3. Teachers with more teaching experience will perceive more external barriers to metric change than teachers with less teaching experience.

The rationale for these hypotheses under Teaching Experience would parallel the rationale in subhypothesis A - Age. The reason this section is included is the fact that an individual's age may or may not be directly related to the number of years he has been teaching. An individual could have started a teaching career later in life in contrast to the individual who begins teaching directly after graduation from college.

E. Participation in Metric Inservice or Metric Workshops or Metric Seminars

1. Teachers who have participated in metric workshops, metric inservice, or metric seminars will be more ready to change than teachers who have not participated in metric workshops, metric inservice, or metric seminars.
2. Teachers who have participated in metric workshops, metric inservice, or metric seminars will perceive fewer internal barriers to metric change than teachers who have not participated in metric

workshops, metric inservice, or metric seminars.

3. Teachers who have participated in metric workshops, metric inservice, or metric seminars will perceive fewer external barriers to metric change than teachers who have not participated in metric workshops, metric inservice, or metric seminars.

Metric workshops, inservice, and seminars are occurring at universities, intermediate school districts, and at the local district level. It is believed that if these workshops have been successful, many of the barriers, both internal and external, perceived by the individual should have been overcome by allowing the participants an opportunity to explore, learn and be comfortable with the metric system. It also is believed that teachers who have participated in metric workshops, inservice and seminars will be more ready to change.

Instrumentation

The questionnaire is composed of three sections. The first section contains items of a demographic nature chosen by the researcher. The second section is Trumbo's Readiness to Change Scale and the third section

contains an instrument designed by the researcher to measure barriers to metric change.

The Readiness to Change Scale was developed and perfected by Donald A. Trumbo in an unpublished doctoral dissertation, "An Analysis of Attitudes Toward Change Among the Employees of an Insurance Company" (Michigan State University, 1958). Trumbo's study attempted to measure the attitudes towards change of 232 employees and forty-six supervisors towards the introduction of the International Business Machine "650" digital computer designed to perform several clerical operations resulting in a degree of job mix change in work flow, and change in the operation procedures.

The Readiness to Change Scale uses a five-point Lickert-type scale to measure the degree of agreement or disagreement with nine items. For ease of reading, the nine items on the Readiness to Change Scale are presented below.

1. If I could do as I pleased, every few months I would change the kind of work I do.
2. One can never feel at ease on a job where the ways of doing things are always being changed.
3. The trouble with teaching is that you just get used to doing things one way and then they want you to do them differently.
4. I would prefer to keep my present assignment which I know I can handle than to change to one where most things would be new to me.

5. The trouble with many people is that when they find a job they can do well they don't stick with it.

6. I like a job where I know that I will be doing my work about the same way from one week to the next.

7. When I get used to doing things in one way, it is disturbing to have to change to a new method.

8. It would take a sizable raise in pay for me to accept a different assignment here.

9. The job that you would consider ideal for you would be one where the way you do your work. . . .

The first eight items used the following responses:

a. I strongly agree.
b. I agree a little.
c. I neither agree nor disagree.
d. I disagree a little.
e. I strongly disagree.

Item 9 used a different response format:

a. Is always the same.
b. Changes very little.
c. Changes somewhat
d. Changes quite a bit.
e. Changes a great deal.

A numerical value was assigned to each response in the Readiness to Change Scale ranging from one to five, with response "c" receiving a numerical value of three. A high numerical score on the Readiness to Change Scale would indicate a propensity to be less ready to change while a low numerical score would indicate more of a readiness to change.

An analysis indicated that the Readiness to Change Scale was a reliable and valid measure of attitudes:

> Tests of the validity of the scale were based on the assumption that favorable attitudes toward change, per se, should be associated with favorable responses to specific change events and with evidence of preparation for change through participation in training programs. These predictions were supported by the data; change scale scores were predictive of responses to past, current and anticipated future changes in work, to a large element of change as a job characteristic, and to opportunities for preparing for change through additional training.[74]

W. A. Faunce in writing for Social Forces also described the reliability and validity of the Readiness to Change Scale:

> . . . item score means of upper and lower groups selected from the total distribution were significantly different at least at .01 level for each of the nine items. The product-movement correlation between scores on this scale for the two administrations of the questionnaire was .63. This would seem to indicate adequate test-retest stability over the six-month period when factors which could be expected to increase or decrease "readiness to change" during this period are consolidated.
>
> The validity of the scale is more difficult to assess but there is evidence of logical or construct validity. Respondents with high scores on the Readiness to Change Scale reacted more favorably to the particular changes in their jobs occurring during the period of the study. They were also more likely to be engaged in their jobs through participation in formal training program.
>
> . . . the coefficient of correlation between scores on the Readiness to Change Scale and scores on a job satisfaction scale was -.15. While this is a statistically significant relationship

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[74] Donald A. Trumbo, "An Analysis of Attitudes Toward Change Among the Employees of an Insurance Company" (Doctoral dissertation, Michigan State University, 1958), Dissertation Abstracts International, 1959, 14, 3395-3396.

> ($p < .05$), job satisfaction accounts for very little of the variance in attitudes toward change in work content.[75]

To further develop Trumbo's Readiness to Change Scale, this researcher did an analysis measuring the homogeneity of each question in relation to every other question in the Readiness to Change Scale. This was done by using Cronbach's alpha coefficient. The alpha coefficient is a measure of reliability that subsumes most of the split-half and Kuder-Richardson coefficients. It has also proved to be a lower bound to the true reliability. This characteristic means that alpha is a conservative estimate of the reliability of a composite. The alpha coefficient treats each item in a composite as a parallel variable.[76]

Using Cronbach's alpha, the total item correlation on the pilot study was .6833 which is a significant enough total item correlation to be used. However, on close examination using step-wise alpha of item by item correlations, it was found that item one on the Readiness to Change Scale had a significant lower correlation than did the other eight items. The deletion of item one on the pilot study increased the alpha to .730 which is

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[75]William A. Faunce, "Social Stratification and Attitude Toward Change in Job Content," Social Forces 39 (December 1960): 140-148.

[76]Herbert L. Castner, ed., Sociological Methodology 1973-1974 (San Francisco: Jossey-Bass, 1974), p. 19.

considered significant. The deletion of other items from the Readiness to Change Scale on the pilot study did not significantly increase the alpha. It was therefore determined by the researcher to use the eight-item Readiness to Change Scale instead of the nine-item scale previously used.

In the final study, the nine-item Readiness to Change Scale was presented to the subjects to insure that the statistical analysis in the pilot study was accurate and the results were not due to the small number of subjects used. The analysis of the pilot study proved to be accurate with alpha correlation in the main study of .699 for the nine-item Readiness to Change Scale and .754 for the eight-item scale. These correlations were accurate and within statistical limits of the alpha in the pilot study. The researcher therefore determined that the eight-item Readiness to Change Scale would be used in the final analysis of the main study.

Table 3.3 provides the reader with a more detailed analysis of Cronbach's alpha correlations used on the nine-item Readiness to Change Scale while Table 3.4 details the alpha correlations on the eight-item Readiness to Change Scale. Appendix A, page 123, details the alpha correlations on the pilot study.

The instrument developed by the researcher and used in this study was primarily based upon the

TABLE 3.3

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE NINE-ITEM READINESS TO CHANGE SCALE

Statement	Correlation
1	-.0410
2	.4651
3	.5962
4	.5385
5	.1995
6	.4221
7	.6074
8	.2834
9	.4601

Alpha for 9-item scale .6999

TABLE 3.4

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE EIGHT-ITEM READINESS TO CHANGE SCALE

Statement	Correlation
2	.4787
3	.6128
4	.5287
5	.2010
6	.4459
7	.6205
8	.3311
9	.4775

Alpha for 8-item scale .754

interpretation of statements made by teachers with whom the writer had contact in his work, and with conversations with fellow graduate students and professors. The development of the final instrument resulted from a critical review by three Michigan State University professors: Dr. Bruce Mitchell, Dr. Loren Woodby, and Dr. William Fitzgerald. Each critically reviewed each question under the guidelines: (1) Are the statements clear? Do you understand them well enough to respond to them? (2) Do the statements reflect, in your opinion, barriers to metric change? Based on their criticisms and responses, the wording of some items was modified to make statements clearer, some items were deleted, and some were added. The final instrument was compiled as a result of these changes.

The final instrument consists of forty-two statements designed to measure barriers to metric change as perceived by the teacher. These forty-two statements are categorized into two general areas: those statements that reflect internal barriers (the self) and those statements that reflect external barriers. For the purpose of this study, the internal barriers are considered to be those which the teacher perceives to be the result of inward stimulation. External barriers are those that the teacher perceives originating outside the self.

The final instrument to which the subjects responded appears in Appendix C, page 154. The following items from the instrument are categorized as internal barriers to metric change.

Internal Barriers

11. I am optimistic about teaching metric.

14. I become upset with those who suggest that I change and teach metric now.

20. I would feel secure in teaching the metric system to my students.

22. I feel discouraged in my attempt to learn the metric system.

26. I feel that I am not knowledgeable enough about the metric system to teach it.

28. When I try to teach the metric system I feel frustrated.

29. I lack the self-confidence necessary to help my students to learn the metric system.

31. I hesitate to teach the metric system because I fear failure.

36. I do not have enough experiences in the metric system to do the kind of teaching I would like to do.

37. I seem to lack the enthusiasm to try and teach my students about the metric system.

41. At this time I do not see a purpose in teaching about the metric system.

44. My personality is not suited for a new curriculum in the metric system.

45. I seem to lack the incentive I need to do a good job of teaching metric.

46. I understand the underlying principles of the metric system.

51. I do not know many meaningful activities involving use of the metric system.

The following items from the instrument are categorized as external barriers to metric change.

External Barriers

10. I feel that I would not receive strong support from my superiors if I attempted to teach only metric measurement and did not teach English measurements.

12. The individual teacher is rarely consulted when the curriculum is being changed.

13. I can't make the change in teaching to metric until the school provides sufficient supplies and materials.

15. Other teachers have helped me as I work with the metric system.

16. The board of education is sincere about trying to help the teachers change to metric.

17. I have enough time to teach those things in the metric system that the student must know.

18. The superintendent is concerned about the instructional problems of the metric system in the schools.

19. The schools have enough money for metric education.

21. If I taught the metric system instead of the current English system, other teachers would be critical of me.

23. I have the materials I need with which to teach the metric system effectively.

24. Faculty meetings in which metric education is discussed would be of value to me.

25. The principal does not support efforts to teach the metric system.

27. The curriculum workers in our school district do not understand the true picture of how things are in the classroom.

30. The people who plan and make the metric curriculum expect too much of the classroom teacher.

32. A teacher can't be expected to do a good job of teaching the metric system and still fulfill all the other tasks expected of him/her.

33. I do not feel that I can attempt to teach metric when the students' work in the other areas is behind that of other classes.

34. I feel that my educational training is adequate for the kind of teaching I plan to do in the metric system.

35. You can't expect a teacher to teach the metric system when there are more than thirty pupils in a class.

38. Only those teachers who teach math and science should teach the metric system to the students.

39. There is a lack of good source books on the metric system.

40. It is a waste of time teaching the students about the metric system when most of them don't care and see no purpose in it.

42. I would use films on the metric system if they were available when I wanted them.

43. There is no agreed upon curriculum on metric education in our school.

47. There is no need to teach the metric system because the students are not yet able to use it in everyday life experiences.

48. The inservice education I have experienced has only frustrated my efforts to learn and teach the metric system.

49. Lack of cooperation from parents makes it difficult to teach the metric system.

50. The metric system is difficult to learn.

The instrument developed by the researcher, like the Readiness to Change Scale, uses a Likert-type five-point scale ranging from strongly agree to strongly disagree. A numerical value was assigned to each answer ranging from one to five with the response "neither agree nor disagree" receiving a numerical value of three.

It should be noted that the questionnaire contained several reverse statements and the scoring thus would proceed from five to one instead of one to five. The reversals were statements:

11	17	20	24	34
15	18	22	25	42
16	19	23	26	46

In determining the reliability of the instrument, the researcher again used Cronbach's alpha for both a reliability coefficient for internal barriers to metric change and external barriers to metric change, as well as a reliability coefficient for total barriers.

The internal barriers have a reliability coefficient alpha of .8911 which is sufficient to be considered reliable. The external barriers have a reliability coefficient alpha of .8276 which is somewhat less than the coefficient for internal barriers, but

nonetheless is sufficiently high to be reliable. The reliability coefficient alpha for total barriers, all forty-two items, was .910 which is considered very high.

The above analysis provides the basis for the use of the instrument by the researcher in this study.

Statistical Analysis

The following discussion of procedures to be utilized in the analysis of data collected will be organized on the basis of each hypothesis. Each hypothesis will be itemized and the procedures to be utilized in answering the question discussed.

Hypotheses I, Ia and Ib

The data collected to study hypotheses I, Ia, and Ib were analyzed through the use of a Chi-square and a Pearson Product-Moment Correlation which measured the degree of relationship between the Readiness to Change Scale and total barriers, internal barriers and external barriers, as well as the direction the relationship has.

Hypothesis Ic

In order to analyze data for hypothesis Ic, which dealt with the measurement of relationship between internal and external barriers and a high degree of readiness to change, the Pearson Product-Moment Correlation was again used along with a Chi-square analysis

and a difference score which further indicates direction of the relationship.

Hypothesis A. Age - 1a, 2a and 3a

The procedures to study the questions based on hypothesis A. Age - 1a, 2a, and 3a were by means of a Chi-square and the Pearson Product-Moment Correlation. These dealt with the relationship and direction between age and readiness to change scores, internal barriers, external barriers and total barriers to metric change.

Hypothesis B. Sex - 1b, 2b and 3b

The data collected to study hypothesis B. Sex - 1b, 2b, and 3b were analyzed through the use of an independent *t*-test which measured the relationship between two groups: sex and readiness to change, sex and internal barriers, and sex to external barriers.

Hypothesis C. Degree Held - 1c, 2c and 3c

Procedures to study the questions posed by hypothesis C. Degree Held - 1c, 2c, and 3c were virtually identical to those used for hypothesis B. Sex - 1b, 2b, and 3b, as the sample used only contained two groups of college degrees. Here the independent *t*-test measured the relationship between degree levels and readiness to change, internal barriers, and external barriers.

Hypothesis D.
Teaching Experience - 1d, 2d, and 3d

In order to analyze data for hypothesis D. Teaching Experience - 1d, 2d, and 3d, the use of Chi-square and the Pearson Product-Moment Correlation was again employed to measure the degree of relationship between teaching experience and internal barriers and external barriers.

Hypothesis E. Participation in Metric Inservice, Metric Workshops or Metric Seminars - 1e, 2e, and 3e

Procedures to study the questions posed by hypothesis E - 1e, 2e, and 3e, were virtually identical to those used for hypothesis B. Sex. Again the independent t-test was used which measured the relationship between two groups: participation in metric inservice, metric workshops, or metric seminars and readiness to change, internal barriers and external barriers to metric change.

Pilot Study

The pilot study was conducted in the summer of 1976 at Michigan State University. The sample was a group of graduate students enrolled in Education 881 - Workshop: Teaching Mathematics Grades Kindergarten through Six.

The purpose of the pilot study was to test administration procedures using the Readiness to Change

Scale and the instrument developed by the researcher and to have a group of participants react to the questionnaire.

The results of the pilot study were somewhat inconclusive due to the small number of participants. However, the pilot study did aid the researcher in determining the statistical procedures that would be used in the main study as well as help the researcher become familiar with these techniques. The pilot study also gave the researcher clues to possible outcomes of the main study. The results of the pilot study are reported in Appendix A.

Summary

This chapter has considered the collection of data, characteristics of the sample, instruments used, hypotheses, statistical procedures, and the pilot study. Chapter IV will be concerned with an analysis of the data.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

The elements of Chapter IV include the presentation of the collected data and analysis of data as described in Chapter III, a brief discussion of the variables, and an explanation of the regrouped demographic variables. The findings are presented in the following manner: first, characteristics of the samples included in the analysis are described and secondly, the results of the analysis are displayed following the statement of the null hypotheses. Statistically significant findings in each table are denoted by an asterisk.

Additional data are also presented and analyzed which are thought to be of interest but not central to the purpose of this study.

The Readiness to Change Variable

The readiness to change variable used represents an attitude of generalized readiness to accept job-related change of an unspecified nature. It can also be interpreted as reflecting opposition to job-related changes. The readiness to change variable may be perceived as a general personality measure.

The Barriers as Variables

The barrier variables used in this study represent forty-two statements which were developed to be perceived barriers to metric change. These forty-two statements are categorized into two general areas--those that reflect internal barriers to metric change and those that reflect external barriers to metric change.

Additional data have been analyzed by categorizing the external barriers to metric change into five specific areas--personnel, materials and supplies, time, students and parents, and training. Although these areas are not central to the study, an analysis of them is presented at the end of this chapter.

Demographic Variables

At the outset of this investigation, it seemed reasonable that certain demographic variables should be collected and that these variables might have some bearing on the readiness to change variable and the perceived barriers to metric change.

Since there was no way of knowing in advance which factors would be related to the major variables, a list of demographic variables was selected. The list is as follows:

Age
Sex
Teaching Experience
Participation in Metric Inservice, Metric Workshops, or Metric Seminars

Degree Held
Teaching Level

Each of these demographic variables was considered in relation to the readiness to change variable and the perceived barriers to metric change.

Regrouping of the Demographic Variables

For purposes of statistical analysis in terms of the hypotheses, certain demographic variables were regrouped for comparison. Each group within a demographic variable was compared with every other group in that variable. Table 4.1 shows the regrouped demographic variables of age, sex, and teaching level. Table 4.2 shows the regrouped demographic variables of highest degree, experience, and participation in metric workshops, metric inservice, or metric seminars.[77]

Samples Included in the Analysis

A total of 160 full-time equivalent elementary teachers were employed by the selected school district. Of this population, 154 or 96 percent elected to participate in the study. The characteristics of this sample grouped for statistical analysis are outlined in Tables 4.1 and 4.2. There is no available data on the six teachers who did not participate.

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[77]The reader may wish to refer to Tables 3.1 and 3.2 for a more detailed analysis of the demographic variables of the sample.

TABLE 4.1

REGROUPED CHARACTERISTICS OF THE SAMPLE
AGE, SEX, AND TEACHING LEVEL

Characteristic	Frequency Observed	Percentage Observed
Age		
20-29 years	17	11.2
30-39	44	29
40-49	45	29.6
50 and above	46	30.2
TOTAL	152	100.00
Sex		
Male	20	13.1
Female	133	86.9
TOTAL	153	100.00
Teaching Level		
K	12	7.8
1	29	19.0
2	27	17.6
3	27	17.6
4	25	16.3
5	21	13.7
Other	12	7.8
TOTAL	153	100.00

TABLE 4.2

REGROUPED CHARACTERISTICS OF THE SAMPLE HIGHEST DEGREE HELD, EXPERIENCE, AND PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS

Characteristics	Frequency Observed	Percentage Observed
Degree Held		
B.A.	77	50.3
M.A.	76	49.7
Doctorate	--	----
TOTAL	153	100.00
Experience		
< 1-4 years	10	6.7
5-9	36	23.5
10-14	31	20.3
15-19	30	19.6
≥ 20	46	30.1
TOTAL	153	100.00
Participation in Metric Workshops, Metric Inservice, Metric Seminars		
Yes	82	53.6
No	71	46.4
TOTAL	153	100.00

Null Hypothesis I. *There is no relationship between scores on the Readiness to Change Scale and the number of total barriers teachers perceive to metric change.*

The results of the data presented in Table 4.3 indicate there is a relationship between scores on the Readiness to Change Scale and the number of total barriers teachers perceive to metric change. This relationship is significant at the .05 level and the null hypothesis is rejected. Furthermore, the direction indicated by the Pearson Product-Moment Correlation suggests that teachers who are more ready to change perceive fewer total barriers to metric change. The results indicate there is a close relationship between scores on the Readiness to Change Scale and the number of total barriers teachers perceive to metric change.

TABLE 4.3

RELATIONSHIP BETWEEN SCORES ON THE READINESS TO CHANGE SCALE AND THE NUMBER OF TOTAL BARRIERS PERCEIVED

	Readiness to Change			
Total Barriers	Low	Medium	High	Statistic
Low	30	13	9	$\chi^2 = 22.20$
Medium	9	18	19	d.f. = 4
High	11	17	23	p = .000*
TOTALS	50	48	51	r = .42

*Asterisk denotes statistically significant findings.

Null Hypothesis Ia. *There is no relationship between scores on the Readiness to Change Scale and the number of internal barriers teachers perceive to metric change.*

According to the analysis of the data presented in Table 4.4, a significant relationship does exist between scores on the Readiness to Change Scale and the number of internal barriers teachers perceive to metric change. The observed statistical significance level of .0012 is sufficient to reject the null hypothesis. Furthermore, the Pearson Product-Moment Correlation computed indicates the correlation is in the predicted direction. The results of this analysis indicate that teachers who are more ready to change perceive fewer internal barriers.

TABLE 4.4

RELATIONSHIP BETWEEN SCORES ON THE READINESS TO CHANGE SCALE AND THE NUMBER OF INTERNAL BARRIERS PERCEIVED

	Readiness to Change			
Internal Barriers	Low	Medium	High	Statistic
Low	26	18	8	$\chi^2 = 18.0$
Medium	13	14	19	d.f. = 4
High	9	18	25	p = .001*
TOTALS	48	50	52	r = .38

Null Hypothesis Ib. *There is no relationship between scores on the Readiness to Change Scale and the number of external barriers teachers perceive to metric change.*

The results displayed in Table 4.5 indicate that a significant relationship does exist between scores on the Readiness to Change Scale and the number of external barriers teachers perceive to metric change. The null hypothesis is rejected. Furthermore, the Pearson Product-Moment Correlation is in the predicted direction. The results indicate that teachers who are more ready to change perceive fewer external barriers to metric change.

TABLE 4.5

RELATIONSHIP BETWEEN SCORES ON THE READINESS TO CHANGE SCALE AND THE NUMBER OF EXTERNAL BARRIERS PERCEIVED

	Readiness to Change			
External Barriers	Low	Medium	High	Statistic
Low	30	10	13	$\chi^2 = 27.13$
Medium	9	16	21	d.f. = 4
High	7	22	23	p = .000*
TOTALS	46	48	57	r = .39

Null Hypothesis Ic. *No differences exist between the number of internal or external barriers to metric change perceived by teachers who exhibit a greater readiness to change.*

An analysis of the data presented in Table 4.6 indicates that significant differences do not exist at the .05 level between the number of internal or external barriers perceived to metric change and scores on the readiness to change scale. The null hypothesis is not rejected; however, when a Pearson Product-Moment Correlation matrix was computed, direction is indicated. The direction of this correlation indicates that the less a teacher was ready to change, the more internal barriers, as compared to external barriers, were perceived.

TABLE 4.6

RELATIONSHIP BETWEEN THE NUMBER OF INTERNAL AND EXTERNAL BARRIERS PERCEIVED AND SCORES ON THE READINESS TO CHANGE SCALE

Readiness to Change	Difference		Statistic
	External	Internal	
Low	39	13	$\chi^2 = 5.89$
Medium	24	21	d.f. = 2
High	36	14	p = .052
TOTALS	99	48	
	Readiness to Change		r = .16
	Internal Barriers		r = .74
	External Barriers		r = .03
	Difference		65

A. Age

Null Hypothesis 1a. *No relationship exists between scores on the Readiness to Change Scale and teacher's age.*

The results of the analysis presented in Table 4.7 indicate that no relationship exists between a high score on the Readiness to Change Scale and teacher's age. Since significant relationships were not demonstrated by the data, the null hypothesis is not rejected.

Attempting to assess the degree to which age and scores on the Readiness to Change Scale vary together, the value of a Pearson Product-Moment Correlation was determined. This value indicates that virtually no relationship existed between the two variables.

TABLE 4.7

RELATIONSHIP BETWEEN SCORES ON THE READINESS TO CHANGE SCALE AND AGE

Readiness to Change	Age 20-29	30-39	40-49	50 and above	Statistic
Low	5	18	13	16	$\chi^2 = 3.84$
Medium	4	12	18	13	d.f. = 6
High	8	14	14	16	p = .63
TOTALS	17	44	45	45	r = -.0049

Null Hypothesis 2a. *No relationship exists between perceived internal barriers to metric change and teacher's age.*

No relationship exists between perceived internal barriers to metric change and teacher's age. As can be seen from the information in Table 4.8, the .05 level of significance was not achieved. No rejection of the null hypothesis is confirmed.

In an effort to determine the degree to which age and perceived internal barriers vary together, a Pearson Product-Moment Correlation was computed. The value of this r indicated that the two variables display little tendency to vary together. That is, it is virtually impossible to predict the number of internal barriers perceived from knowing the age of a teacher.

TABLE 4.8

RELATIONSHIP BETWEEN INTERNAL BARRIERS PERCEIVED AND AGE

Internal Barriers	Age 20-29	30-39	40-49	50 and above	Statistic
Low	8	17	11	12	$\chi^2 = 4.29$
Medium	5	14	17	14	d.f. = 6
High	4	13	17	16	p = .63
TOTALS	17	44	45	42	r = .11

Null Hypothesis 3a. *No relationship exists between perceived external barriers to metric change and teacher's age.*

From the results of the data presented in Table 4.9, it is apparent that no relationship exists between teacher's age and perceived external barriers to metric change. This relationship could occur by chance, sixty times in one hundred. This probability level failed to approach the level of significance necessary to reject the null hypothesis. The Pearson Product-Moment Correlation computed to determine the strength of the relationship between the two variables was so low as to indicate that very little association exists.

TABLE 4.9

RELATIONSHIP BETWEEN EXTERNAL BARRIERS PERCEIVED AND AGE

External Barriers	Age 20-29	30-39	40-49	50 and above	Statistic
Low	4	15	13	14	$\chi^2 = 4.50$
Medium	9	11	15	13	d.f. = 6
High	4	17	17	17	p = .60
TOTALS	17	43	45	44	r = .06

B. Sex

Null Hypothesis 1b. *No differences exist between male teachers' scores on the Readiness to Change Scale and female teachers' scores on the Readiness to Change Scale.*

The results of the analysis presented in Table 4.10 indicate that no significant difference exists between sex and scores on the Readiness to Change Scale. Since significant differences were not demonstrated by the data, the null hypothesis is not rejected. The data indicate that there is no significant difference between male scores and female scores on the Readiness to Change Scale.

TABLE 4.10

RELATIONSHIP BETWEEN MALE AND FEMALE TEACHERS ON THE READINESS TO CHANGE SCALE

	Male	Female	df	t	p
N:	20	132			
M:	2.82	2.97	150	.83	.40
SD:	.64	.77			

Null Hypothesis 2b. *No differences exist between the number of internal barriers perceived by male teachers and the number of internal barriers perceived by female teachers.*

From the data presented in Table 4.11, it is apparent that differences which exist between the number of internal barriers to metric change perceived by male teachers and the number of internal barriers to metric change perceived by female teachers were significant. The null hypothesis is rejected since male teachers perceived fewer internal barriers to metric change than female teachers.

TABLE 4.11

RELATIONSHIP BETWEEN MALE AND FEMALE TEACHERS AND INTERNAL BARRIERS TO METRIC CHANGE

	Male	Female	df	t	p
N:	20	129			
M:	1.97	2.55	147	3.17	.001*
SD:	.69	.77			

Null Hypothesis 3b. *No differences exist between the number of external barriers perceived by male teachers and the number of external barriers perceived by female teachers.*

According to the findings in Table 4.12, no significant difference exists regarding sex and the number of external barriers perceived to metric change. However, it would seem that males perceive fewer external barriers to metric change than females, and that this

difference could occur by chance twenty-four times in one hundred. This level is not sufficient to reject the null hypothesis.

TABLE 4.12

RELATIONSHIP BETWEEN MALE AND FEMALE TEACHERS AND EXTERNAL BARRIERS TO METRIC CHANGE

	Male	Female	df	t	p
N:	20	130			
M:	2.66	2.81	148	1.17	.24
SD:	.42	.54			

C. Degree Held

Null Hypothesis 1c. *No relationship exists between professional education training and scores on the Readiness to Change Scale.*

The results displayed in Table 4.13 indicate that no relationship was observed between degrees teachers held and scores on the Readiness to Change Scale. The reported relationship could occur by chance seventy-seven times in one hundred. The null hypothesis was not rejected. The analysis indicates that the degree the teacher has attained does not affect the score on the Readiness to Change Scale.

TABLE 4.13

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATION TRAINING AND A HIGH SCORE ON THE READINESS TO CHANGE SCALE

	B.A.	M.A.	df	t	p
N:	76	76			
M:	2.94	2.97	150	.28	.77
SD:	.75	.75			

Null Hypothesis 2c. *No relationship exists between professional education training and the number of perceived internal barriers to metric change.*

The results of the analysis shown in Table 4.14 indicate that no significant relationship exists between degrees held by teachers and the number of perceived internal barriers to metric change. The observed results could occur by chance fifty-one times in one hundred. This observed statistical significance level of .51 is not sufficient to reject the null hypothesis.

TABLE 4.14

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATIONAL TRAINING AND INTERNAL BARRIERS TO METRIC CHANGE

	B.A.	M.A.	df	t	p
N:	74	75			
M:	2.43	2.51	147	.64	.51
SD:	.78	.78			

Null Hypothesis 3c. *No relationship exists between professional education training and the number of perceived external barriers to metric change.*

The results displayed in Table 4.15 indicate that no relationship was observed between degrees held by teachers and the number of perceived external barriers to metric change. The null hypothesis was not rejected.

TABLE 4.15

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATION TRAINING AND EXTERNAL BARRIERS TO METRIC CHANGE

	B.A.	M.A.	df	t	p
N:	74	76			
M:	2.77	2.82	148	.49	.62
SD:	.51	.55			

D. Teaching Experience

Null Hypothesis 1d. *No relationship exists between teaching experience and scores on the Readiness to Change Scale.*

Significant relationship does not exist between teaching experience and scores on the Readiness to Change Scale. As can be seen from the information in Table 4.16, the .05 level of significance was not achieved, and no rejection of the null hypothesis is confirmed.

In an effort to determine the degree to which teaching experience and scores on the Readiness to Change Scale vary together, a Pearson Product-Moment Correlation was computed. The value of this r indicated that the two variables display almost no tendency to vary together.

TABLE 4.16

RELATIONSHIP BETWEEN TEACHING EXPERIENCE AND SCORE ON THE READINESS TO CHANGE SCALE

Readiness to Change	Teaching Experience <1-4	5-9	10-14	15-19	≥20	Statistic
Low	5	14	10	7	17	$\chi^2 = 4.87$
Medium	1	10	10	11	15	df = 8
High	4	12	11	12	13	p = .77
TOTALS	10	36	31	30	45	r = .02

Null Hypothesis 2d. *No relationship exists between teaching experience and the number of perceived internal barriers to metric change.*

From the results of the data presented in Table 4.17, it is apparent that no relationship exists between teaching experience and number of internal barriers to metric change perceived by the teacher. The probability level of .78 failed to approach the level of significance necessary to reject the null hypothesis.

The Pearson Product-Moment Correlation computed to determine the strength of the relationship between the two variables was so low as to indicate that very little association does exist between the two.

TABLE 4.17

RELATIONSHIP BETWEEN TEACHING EXPERIENCE AND INTERNAL BARRIERS

Internal Barriers	Teaching Experience ≤1-4	5-9	10-14	15-19	≥20	Statistic
Low	5	13	10	9	11	$\chi^2 = 4.7$
Medium	3	13	9	12	13	df = 8
High	2	10	12	9	18	p = .78
TOTALS	10	36	31	30	42	r = .10

Null Hypothesis 3d. *No relationship exists between teaching experience and the number of perceived external barriers to metric change.*

Significant relationship does not exist between teaching experience and the number of perceived external barriers to metric change. As can be seen from the information in Table 4.18, the .05 level of significance was not achieved; no rejection of the null hypothesis is confirmed.

An effort was made to determine the degree to which teaching experience and perceived external barriers vary together; a Pearson Product-Moment Correlation was computed. The value of this r indicated that the two variables displayed no tendency to vary together.

TABLE 4.18

RELATIONSHIP BETWEEN TEACHING EXPERIENCE AND EXTERNAL BARRIERS

External Barriers	Teaching Experience ≤1-4	5-9	10-14	15-19	≥20	Statistic
Low	2	11	9	9	15	$\chi^2 = 4.23$
Medium	6	10	10	9	13	df = 8
High	2	14	12	12	16	p = .83
TOTALS	10	35	31	30	44	r = .00

E. Participation in Metric Inservice, Metric Workshops or Metric Seminars

Null Hypothesis 1e. *No differences exist between scores on the Readiness to Change Scale for teachers who have participated in metric workshops, metric inservice, or metric seminars and scores on the Readiness to Change Scale for teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

According to the findings indicated in Table 4.19, no significant differences exist between scores on the Readiness to Change Scale and participation in metric workshops, metric inservice, or metric seminars at the .05 level of significance. However, at the .10 level of significance, participation in metric workshops, metric inservice, or metric seminars would influence mean scores on the Readiness to Change Scale.

TABLE 4.19

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND SCORES ON THE READINESS TO CHANGE SCALE

	Participation	Non Participation	df	t	p
N:	81	71			
M:	2.84	3.08	150	-1.95	.052
SD:	.26	.77			

Null Hypothesis 2e. *No differences exist between the number of perceived internal barriers to metric change by teachers who have participated in metric workshops, metric inservice, or metric seminars and the number of perceived internal barriers to metric change by teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

Differences are apparent, in Table 4.20, in the number of perceived internal barriers and participation in metric workshops, metric inservice, and metric seminars. The analysis indicates that differences could not occur by chance and indeed having participated in a metric workshop, metric inservice, or metric seminar does influence the number of perceived internal barriers to metric change. Based on these data, the null hypothesis is rejected.

TABLE 4.20

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND INTERNAL BARRIERS TO METRIC CHANGE

	Participation	Non-Participation	df	t	p
N:	79	70			
M:	2.23	2.75	147	-4.27	.00*
SD:	.71	.76			

Null Hypothesis 3e. *No differences exist between the number of perceived external barriers to metric change by teachers who have participated in metric workshops, metric inservice, or metric seminars and the number of perceived external barriers to metric change by teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

According to the analysis of the data presented in Table 4.21, a significant relationship does exist between teachers who have participated in metric workshops, metric inservice, or metric seminars and the number of external barriers to metric change perceived by teachers. Those teachers who have participated in metric workshops, metric inservice, or metric seminars perceived fewer external barriers to metric change than teachers who have not participated. The observed statistical significance level of .002 is sufficient to reject the null hypothesis.

TABLE 4.21

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND EXTERNAL BARRIERS TO METRIC CHANGE

	Participation	Non-Participation	df	t	p
N:	81	69			
M:	2.68	2.93	148	-3.04	.002*
SD:	.48	.55			

Additional Analysis

This section presents the additional analysis of certain grouped external barriers to metric change as they relate to readiness to change and the demographic variables used in this study. Although this expanded analysis is not central to the study, it is thought to be of interest to the reader.

Certain items in the instrument developed by the researcher, particularly those relating to external barriers to metric change, can be categorized into five general areas; those which relate to time, to school personnel, to materials and supplies, to students and parents, and to training. Below are the items from the questionnaire categorized into the five areas.

Time as a Barrier to Metric Change

17. I have enough time to teach those things in the metric system that the student must know.

32. A teacher can't be expected to do a good job of teaching the metric system and still fulfill all the other tasks expected of him/her.

School Personnel as Barriers to Metric Change

10. I feel that I would not receive strong support from my superiors if I attempted to teach only metric measurement and did not teach English measurements.

12. The individual teacher is rarely consulted when the curriculum is being changed.

15. Other teachers have helped me as I work with the metric system.

16. The board of education is sincere about trying to help the teachers change to metric.

18. The superintendent is concerned about the instructional problems of the metric system in the schools.

21. If I taught the metric system instead of the current English system, other teachers would be critical of me.

25. The principal does not support efforts to teach the metric system.

27. The curriculum workers in our school district do not understand the true picture of how things are in the classroom.

30. The people who plan and make the metric curriculum expect too much of the classroom teacher.

38. Only those teachers who teach math and science should teach the metric system to the students.

Materials and Supplies as Barriers to Metric Change

13. I can't make the change in teaching to metric until the school provides sufficient supplies and materials.

19. The schools have enough money for metric education.

23. I have the materials I need with which to teach the metric system effectively.

39. There is a lack of good source books on the metric system.

Students and Parents as Barriers to Metric Change

33. I do not feel that I can attempt to teach metric when the students' work in the other areas is behind that of other classes.

35. You can't expect a teacher to teach the metric system when there are more than thirty pupils in a class.

40. It is a waste of time teaching the students about the metric system when most of them don't care and see no purpose in it.

47. There is no need to teach the metric system because the students are not yet able to use it in everyday life experiences.

49. Lack of cooperation from parents makes it difficult to teach the metric system.

Training as a Barrier to Metric Change

24. Faculty meetings in which metric education is discussed would be of value to me.

34. I feel that my educational training is adequate for the kind of teaching I plan to do in the metric system.

48. The inservice education I have experienced has only frustrated my efforts to learn and teach the metric system.

50. The metric system is difficult to learn.

Table 4.22 shows that the correlations of each question in the five categories are sufficiently high to continue the expanded analysis. It should be noted that all external barriers are not included in these five categories as some questions did not fit the categories.

TABLE 4.22

CORRELATIONS OF THE QUESTIONS
IN THE FIVE CATEGORIES

Category	Alpha
Time	.53
School Personnel	.57
Materials and Supplies	.44
Students and Parents	.78
Training	.34

An analysis of the data presented in Table 4.23 indicates no significant difference between male and female teachers and the mean score in personnel, materials and supplies, time, and students and parents perceived as barriers to metric change. However, in the category, training, males perceive training as less of a barrier to metric change than females. This difference is significant at the .05 level.

The data presented in Table 4.24 show no significant relationship between degree held and mean scores in personnel, materials and supplies, time, students and parents, and training as barriers to metric change.

TABLE 4.23

DIFFERENCE BETWEEN MALES AND FEMALES AND THE MEAN SCORES IN THE FIVE CATEGORIES

		Sex				
Category		Male	Female	df	t	p
Personnel	M:	2.80	2.89			
	SD:	.44	.55	150	-.62	.53
	N:	20	132			
Materials and Supplies	M:	2.94	3.17			
	SD:	.55	.69	151	-1.43	.15
	N:	20	133			
Time	M:	2.37	2.51			
	SD:	1.31	1.10	146	-.52	.59
	N:	20	128			
Students and Parents	M:	2.41	2.58			
	SD:	.80	.98	146	-.70	.48
	N:	20	128			
Training	M:	2.45	2.82			
	SD:	.63	.73	146	-2.13	.03*
	N:	20	128			

TABLE 4.24

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATION TRAINING AND THE MEAN SCORES IN THE FIVE CATEGORIES

		Degree				
Category		B.A.	M.A.	df	t	p
Personnel	N:	76	76			
	M:	2.89	2.87	150	.73	.81
	SD:	.53	.54			
Supplies and Materials	N:	77	76			
	M:	3.17	3.10	151	.63	.52
	SD:	.69	.67			
Time	N:	72	76			
	M:	2.47	2.51	146	.82	.79
	SD:	1.09	1.13			
Students and Parents	N:	73	75			
	M:	2.48	2.63	146	.96	.33
	SD:	.97	.95			
Training	N:	72	76			
	M:	2.71	2.82	146	.86	.38
	SD:	.70	.76			

According to the findings in Table 4.25, no significant relationships exist between participation in metric workshops, metric inservice, or metric seminars and the mean scores in the categories of school personnel or time as barriers to metric change. However, in the categories of materials and supplies, students and parents, and training, those teachers who have participated in metric workshops, metric inservice, or metric seminars did not perceive these as great a barrier as did those teachers who did not participate in metric workshops, metric inservice, or metric seminars. These differences were significant at the .05 level.

The results of the analysis shown in Table 4.26 indicate a positive correlation between the difference score and mean scores on the Readiness to Change Scale. This positive correlation indicates the less ready the participants were to change, the greater the internal barriers perceived as compared to the external barriers. Those participants that show a greater external barrier statistical mean perceived greater supply barriers and personnel barriers. Those participants that show a greater internal barrier statistical mean perceived greater time, students, and training barriers. Except for training, none of the other five categories are significant at the .05 level. Nonetheless, the correlations do indicate direction.

TABLE 4.25

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND THE MEAN SCORES IN THE FIVE CATEGORIES

		Participation				
Category		Yes	No	df	t	p
Personnel	M:	2.80	2.96			
	SD:	.51	.56	150	-1.84	.06
	N:	81	71			
Materials and Supplies	M:	3.31	3.74			
	SD:	.88	.76	150	-3.23	.00*
	N:	81	71			
Time	M:	2.37	2.64			
	SD:	1.09	1.10	146	-1.46	.14
	N:	81	67			
Students and Parents	M:	2.41	2.72			
	SD:	.94	.97	146	-1.90	.05*
	N:	79	69			
Training	M:	2.55	3.03			
	SD:	.72	.65	146	-4.16	.00*
	N:	80	68			

TABLE 4.26

CORRELATIONS BETWEEN MEAN SCORES ON THE READINESS TO CHANGE SCALE, INTERNAL BARRIERS, EXTERNAL BARRIERS, AND MEAN SCORES IN THE FIVE CATEGORIES

Category	R	Statistic
Readiness to Change	.1603	N = 144
Internal Barriers	.7437	df = 142
External Barriers	.0303	R = .1637
Personnel	-.1182	difference 65
Supplies	-.1539	
Time	.0188	difference score equals mean scores on internal
Students	.1370	barriers minus mean scores on external bar-
Training	.3920	riers.

The results displayed in Tables 4.27 and 4.28 indicate a positive correlation between the difference score and mean scores on the Readiness to Change Scale regardless of participation in metric inservice, metric workshops, or metric seminars. In both cases, this positive relationship indicates the less ready the participants were to change, the greater the internal barriers perceived as compared to the external barriers. Those who have participated in metric workshops, metric inservice, or metric seminars, and show a greater external

TABLE 4.27

CORRELATIONS BETWEEN MEAN SCORES ON THE READINESS TO CHANGE SCALE, INTERNAL BARRIERS, EXTERNAL BARRIERS, AND MEAN SCORES IN THE FIVE CATEGORIES FOR THOSE WHO HAVE PARTICIPATED IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS

Category	R	Statistic
Readiness to Change	.1138	N = 78
Internal Barriers	.7331	df = 76
External Barriers	-.1180	R = .2227
Personnel	-.1933	difference = 65
Supplies	-.3597	
Time	-.0307	
Students	.0475	
Training	.2767	

TABLE 4.28

CORRELATIONS BETWEEN MEAN SCORES ON THE READINESS TO CHANGE SCALE, INTERNAL BARRIERS, EXTERNAL BARRIERS, AND MEAN SCORES IN THE FIVE CATEGORIES FOR THOSE WHO HAVE NOT PARTICIPATED IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS

Category	R	Statistic
Readiness to Change	.1441	N = 66
Internal Barriers	.7230	df = 64
External Barriers	.0775	R = .2423
Personnel	-.1136	difference = 65
Supplies	.0060	
Time	.0156	
Students	.1760	
Training	.4394	

barrier statistical mean, perceived fewer personnel, supply, and time barriers. On the other hand, those who have not participated in metric workshops, metric inservice, or metric seminars and show a greater external barrier statistical mean, perceived greater supply, time, students, and training barriers. Except for training, none of the other five categories is significant at the .05 level in participated or have not participated areas. Nonetheless, the correlations do indicate direction.

Summary

Chapter IV presented an analysis of the collected data. As has often been the case, the findings of this study are somewhat less than conclusive in certain areas. As might be expected, teachers who are more ready to change perceive fewer internal and external barriers to metric change than teachers who are less ready to change.

Interestingly, age seems to have no relationship to readiness to change, nor towards the number of internal or external barriers perceived. While no relationship exists between sex and readiness to change, there does seem to be a realtionship between sex and the number of internal barriers perceived. Male teachers perceive fewer internal barriers, while no relationship

exists between sex and the number of external barriers perceived.

The college degree attained has no bearing on readiness to change or on the number of external or internal barriers perceived. The same can also be said for teaching experience.

Participation in metric workshops, metric inservice, or metric seminars had a significant realtionship with regard to the number of internal and external barriers perceived. Those who participated in metric workshops, metric inservice, or metric seminars perceived fewer internal and external barriers. Table 4.28 summarizes the results of this experiment in terms of the level of significance of the compared variables.

In the additional analysis, males perceived training as less of a barrier than females. Those who participated in metric workshops, metric inservice, or metric seminars perceived fewer barriers in the categories of materials and supplies, students and parents, and time.

Chapter V will be concerned with a detailed summary of the study, as well as conclusions and implications of the study.

TABLE 4.29

COMPARISON OF THE VARIABLES IN TERMS OF LEVELS OF SIGNIFICANCE

Variable	Readiness to Change	Internal Barriers	External Barriers
Readiness to Change	----	p = .0012	p = .00
Total Barriers	p = .00	----	----
Age	p = .63	p = .63	p = .60
Sex	p = .40	p = .001	p = .24
Degree Held	p = .77	p = .51	p = .62
Teaching Experience	p = .77	p = .78	p = .83
Participation in Metric Workshops, Metric Inservice, or Metric Seminars	p = .052	p = .00	p = .002

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Chapter V is organized into three sections. The first section contains a restatement of the problem. The second section relates the conclusions drawn from the statistical analysis of the hypotheses and discusses the findings. The third and final section of this chapter presents the implications for practice and suggestions for further research.

Statement of the Problem

The purpose of this study was to attempt to investigate what teachers working in a selected school system and assigned to grades kindergarten through five judge to be the barriers to the implementation of the metric system, to determine the relationship between these barriers and the teacher's readiness to change, and to relate both the barriers and the readiness to change variables with selected demographic data.

Conclusions

Two instruments were used in this study. The Readiness to Change Scale was used to assess teachers'

readiness to change and the instrument developed by the researcher was used to obtain teachers' judgments about barriers to metric change. The following conclusions are based on the data collected through the use of these two instruments. In this section, the null hypothesis is stated, followed by a discussion of the findings and a statement of general conclusion.

Null Hypothesis I. *There is no relationship between scores on the Readiness to Change Scale and the number of total barriers teachers perceive to metric change.*

Findings: The data gathered through the use of the questionnaire served to reject this hypothesis. There is a relationship between scores on the Readiness to Change Scale and the number of total barriers teachers perceive to metric change. Teachers who indicate a higher degree of readiness to change also perceive fewer total barriers to metric change.

Conclusions: It would seem from the data gathered that those teachers who had a high propensity to change and perceived change as being positive either did not perceive many total barriers to metric change, or perceived the barriers as somewhat insignificant and easily overcome. Those teachers who seem to indicate less of a propensity to change may have perceived the barriers to metric change as formidable and possibly as posing a perceivable threat or sense of insecurity to the individual.

Null Hypothesis Ia. *There is no relationship between scores on the Readiness to Change Scale and the number of internal barriers teachers perceive to metric change.*

Findings: The data collected from the participants in the study caused rejection of null hypothesis la. Teachers who were more ready to change perceived fewer internal barriers to metric change than did teachers who were less ready to change.

Conclusions: The internal barriers were defined to be those which the teacher perceives to be the result of inner stimulation, or in fact based on an individual's needs. Change might take place when an individual needs to change and perceives himself/herself as an integral part of the change process. Those teachers who perceived fewer internal barriers probably see themselves as an integral part of the change pattern and desire to make the necessary modifications in their values and beliefs.

Null Hypothesis Ib. *There is no relationship between scores on the Readiness to Change Scale and the number of external barriers teachers perceive to metric change.*

Findings: The analysis of the data gathered caused rejection of null hypothesis Ib. Teachers who were more ready to change perceived fewer external barriers to metric change than did teachers who were less ready to change.

Conclusions: The external barriers were defined as barriers originating outside the "self" or imposed by external sources. Unlike internal barriers the external barriers are more easily perceived and probably more easily overcome. As teachers begin to overcome these external barriers, they gain confidence and insight into their beliefs and values and slowly begin to modify these beliefs and values. When this is undertaken, it can be a rewarding experience which can slowly modify attitudes toward metric change. These conclusions are consistent with the results in hypothesis I.

Null Hypothesis Ic. *No differences exist between the number of internal or external barriers to metric change perceived by teachers who exhibit a greater readiness to change.*

Findings: Null hypothesis Ic was not rejected based on the analysis of the data gathered. Teachers who were more ready to change did not perceive more internal barriers to metric change than external barriers.

Conclusions: The results of this null hypothesis are somewhat inconsistent with the literature discussed in Chapter II. One possible explanation is that people with a high degree of readiness to change may perceive themselves as an integral part of the change process. As they perceive themselves as a part of the

change process, they may become more willing and able to look at their values, beliefs, and attitudes, especially in relationship to other people.

Another explanation might be that teachers who are more ready to change perceived the internal barriers in the same manner they perceived the external barriers, as somewhat insignificant and easily overcome.

A. Age

Null Hypothesis 1a. *No relationship exists between scores on the Readiness to Change Scale and teacher's age.*

Findings: From the data gathered, null hypothesis 1a was not rejected. Age has little influence in determining the teacher's readiness to change.

Conclusions: The results from this null hypothesis are consistent with the literature discussed in Chapter II. Age has little relationship to readiness to change. Older teachers are just as likely to be ready to change as younger teachers.

Null Hypothesis 2a. *No relationship exists between perceived internal barriers to metric change and teacher's age.*

Findings: From the data gathered, null hypothesis 2a was not rejected. Younger teachers do not perceive fewer internal barriers to metric change than older teachers.

Conclusions: Based on the data gathered in this study, age has little influence on the number of internal barriers to metric change perceived by the teacher. This is consistent with the literature presented in Chapter II.

Null Hypothesis 3a. *No relationship exists between perceived external barriers to metric change and teacher's age.*

Findings: Null hypothesis 3a was not rejected based on the data gathered from the participants in this study. Younger teachers do not perceive fewer external barriers to metric change than older teachers.

Conclusions: A widely held belief that the older the teacher's age, the more rigid they have become in their teaching methods and less ready to adopt new methods has not been confirmed by this study. Even though older teachers may have developed certain teaching procedures over the years in which they have succeeded and which make them feel comfortable, they do not perceive more barriers to metric change than the younger teacher who has not had the opportunity to firmly entrench those procedures in his or her teaching style.

B. Sex

Null Hypothesis 1b. *No differences exist between male teacher's scores on the Readiness to Change Scale and mean female teacher's scores on the Readiness to Change Scale.*

Findings: From the analysis of the data null hypothesis 1b was not rejected. Male teachers are not more ready to change than female teachers.

Conclusion: Based on the information gathered in this study, sex has little influence on whether a person is ready to change. Regardless of sex, people will be ready to change when they perceive a need to change.

Null Hypothesis 2b. *No differences exist between the number of internal barriers perceived by male teachers and the number of internal barriers perceived by female teachers.*

Findings: From the data gathered in this study male teachers perceive fewer internal barriers to metric change than female teachers. Given this information, null hypothesis 2b was rejected.

Conclusions: Chapter II presented evidence that due to lack of motivation, interest, and confidence, females tend to shy away from mathematically oriented disciplines. The data gathered in this study confirms this belief. Males do perceive fewer internal barriers to metric change. One other possible explanation for this confirmation is the small number of males that participated in the study. Only twenty (thirteen percent) of the total sample were males. This small number in comparison to the number of females could have skewed the results. Another possible explanation, as put forth

in Chapter II, is that males may have participated more in mathematics-oriented courses at both the high school and college level. This participation may have generated a more positive attitude toward metric change. The positive attitude accompanied with positive beliefs and values toward metric education was no doubt built over time and may have contributed to the outcome of hypothesis 2b.

Null Hypothesis 3b. *No differences exist between the number of external barriers perceived by male teachers and the number of external barriers perceived by female teachers.*

Findings: Null hypothesis 3b was not rejected based on the data gathered. Male teachers do not perceive fewer external barriers to metric change than female teachers.

Conclusions: As stated in Chapter III, the barriers classified as external are believed to be more easily perceived and overcome. This may be one possible explanation for this outcome. Another explanation, as stated in null hypothesis 2b, is that the small number of males that participated in the study could have skewed the results. Based on the data from this study, sex has little influence on the number of perceived external barriers to metric change.

C. Degree Held

Null Hypothesis 1c. *No relationship exists between professional education training and scores on the Readiness to Change Scale.*

Findings: No relationship was observed between degrees teachers held and readiness to change. Teachers with more professional education training are not more ready to change than teachers with less professional education training. Null hypothesis 1c was not rejected.

Conclusion: A widely held belief that when teachers return to graduate school they have been exposed to more educational trends and ideas and therefore are more likely to be ready to change, but the data gathered in this study has not proved this statement to be true. More professional education training has little influence on readiness to change.

Null Hypothesis 2c. *No relationship exists between professional education training and the number of perceived internal barriers to metric change.*

Findings: Teachers with more professional education training do not perceive more internal barriers to metric change than teachers with less professional education training. Based on the data analyzed in this study, null hypothesis 2c was not rejected.

Conclusions: The assumption that was made for hypothesis 2c was that those who have returned for

graduate study were more likely to be aware and sensitive to the potential internal barriers to metric change, and might be more aware of their limitations in overcoming those internal barriers. This assumption is proved to be false. There is virtually no relationship between professional education training and the number of perceived internal barriers to metric change.

Null Hypothesis 3c. *No relationship exists between professional education training and the number of perceived external barriers to metric change.*

Findings: The data gathered to analyze null hypothesis 3c proved that no relationship exists between professional education training and the number of perceived external barriers to metric change. Null hypothesis 3c was not rejected.

Conclusions: As in hypothesis 2c, the assumption that teachers returning to graduate study might be more aware and sensitive to the external barriers to metric change and consequently more aware of their limitations in overcoming those external barriers has proved to be false. There is no relationship between professional education training and the number of external barriers to metric change perceived. The results in null hypothesis 1c, 2c, and 3c are consistent with the literature set forth in Chapter II.

D. Teaching Experience

Null Hypothesis 1d. *No relationship exists between teaching experience and scores on the Readiness to Change Scale.*

Findings: According to the data analyzed, teaching experience has no relationship to readiness to change. Null hypothesis 1d was not rejected.

Conclusions: Null hypothesis 1d parallels null hypothesis 1a, Age. Teaching experience has no relationship to readiness to change. Teachers with more experience are just as likely to be ready to change as teachers with less teaching experience.

Null Hypothesis 2d. *No relationship exists between teaching experience and the number of perceived internal barriers to metric change.*

Findings: From the data gathered, null hypothesis 2d was not rejected. Teaching experience has no relationship to the number of internal barriers perceived to metric change.

Conclusions: The conclusions from null hypothesis 2d parallel that of null hypothesis 2a, Age. Teachers with more teaching experience do not perceive more internal barriers to metric change than teachers with less teaching experience.

Null Hypothesis 3d. *No relationship exists between teaching experience and the number of perceived external barriers to metric change.*

Findings: Null hypothesis 3d was not rejected based on the data gathered from the participants in the study. Teachers with more teaching experience do not perceive more external barriers to metric change than teachers with less teaching experience.

Conclusions: As in null hypothesis 3a, Age, a widely held belief is that teachers with more experience are more rigid in their teaching methods and less ready to adopt new methods. This belief has not been confirmed by this study. Teaching experience has no relationship to readiness to change or the number of external or internal barriers perceived to metric change.

E. Participation in Metric Workshops, Metric Inservice, or Metric Seminars

Null Hypothesis 1e. *No differences exist between scores on the Readiness to Change Scale for teachers who have participated in metric workshops, metric inservice, or metric seminars and scores on the Readiness to Change Scale for teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

Findings: No significant differences exist between scores on the Readiness to Change Scale and participation in metric workshops, metric inservice, or metric seminars at the .05 level of significance. Null hypothesis 1e was not rejected. Participation in metric workshops, metric

inservice, or metric seminars does not influence readiness to change at the .05 level of significance.

Conclusions: Even though null hypothesis 1e was not rejected, it is statistically true at the .10 level of significance that participation in metric workshops, metric inservice, or metric seminars does influence readiness to change.

Null Hypothesis 2e. *No differences exist between the number of perceived internal barriers to metric change by teachers who have participated in metric workshops, metric inservice, or metric seminars and the number of perceived internal barriers to metric change by teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

Findings: The results of the analysis in null hypothesis 2e indicate that those teachers who have participated in metric workshops, metric inservice, or metric seminars perceived fewer internal barriers to metric change than did teachers who did not participate in metric workshops, metric inservice, or metric seminars. Null hypothesis 2e was rejected.

Conclusions: Metric inservice, workshops, and seminars are occurring at universities, intermediate school districts, and at the local district level. It is believed that if these workshops have been successful,

teachers who participated will perceive fewer internal barriers to metric change. The results of null hypothesis 2e has proved this to be true. Those teachers who have participated in metric workshops, metric inservice, or metric seminars did perceive fewer internal barriers to metric change.

Null Hypothesis 3e. *No differences exist between the number of perceived external barriers to metric change by teachers who have participated in metric workshops, metric inservice, or metric seminars, and the number of perceived external barriers to metric change by teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

Findings: The results of the analysis in null hypothesis 3e indicate that those teachers who have participated in metric workshops, metric inservice, or metric seminars perceive fewer external barriers to metric change than did teachers who did not participate in metric workshops, metric inservice, or metric seminars. Null hypothesis 3e was rejected.

Conclusions: This study was not concerned with the types or content of the possible metric workshops, metric inservice, or metric seminars in which the teachers might have participated. It is, however, reasonable to assume that those teachers who have participated in

metric workshops, metric inservice, or metric seminars did not all participate in the same one and, therefore, probably had varying experiences. The experiences probably allowed the participant an opportunity to explore, learn, and be comfortable with the metric system resulting in the ability to overcome both internal and external barriers to metric change.

The section of Chapter IV, Additional Analysis, showed somewhat inconsistent results. There was no significant difference between males and females in the areas of personnel, materials and supplies, time, and students and parents as barriers to metric change. In the area of training, males perceived fewer barriers than females at the .05 level of significance. As pointed out in Chapter II, this could be due to the fact that males traditionally take more mathematics and science courses, and have more technical training than females.

There was no relationship between college degree attained and mean scores in the categories of personnel, materials and supplies, time, students and parents, and training as barriers to metric change.

Significant relationships did exist between participation in metric workshops, metric inservice, or metric seminars and the categories of supplies and materials, students and parents, and training. There was no significant relationship between participation in

metric workshops, metric inservice, or metric seminars and the categories of personnel and time. One possible explanation for personnel and time not being significantly affected by participation in metric workshops, metric inservice, or metric seminars is that mathematics courses seldom contain instruction or discussions on interpersonal relationships among school employees or management of time for effective teaching. Even though personnel and time were not sufficiently affected by participation in metric workshops, metric inservice, or metric seminars to be considered significant, there is direction indicated by the Pearson Product-Moment Correlation. The direction indicates that those teachers who have participated in metric workshops, metric inservice, or metric seminars do tend to perceive fewer personnel and time barriers to metric change.

Implications for Practice and Suggestions for Further Research

A major purpose of this study was to determine teachers' readiness to change in relationship to their perceived barriers to metric change and relate both the barriers and the readiness to change variables with selected demographic variables. This was done in an effort to provide additional information to those curriculum workers whose job it is to work with teachers to implement the metric system in the elementary schools.

The data collected, and the conclusions drawn from this study, suggest direction for these educators to concentrate their efforts. The curriculum workers should consider as they plan metric inservice, metric workshops, or metric seminars, that teachers exhibit varying degrees of readiness to change and the degree to which teachers are ready to change influences the number of perceived internal and external barriers to metric change. Those teachers who are ready to change perceive fewer internal and external barriers to metric change. In addition, as the curriculum workers plan metric workshops, metric inservice, and metric seminars, they should consider not only the technical aspects of the metric system, but also should suggest to the teacher methods in which to deal with the time constraints that are evident in classroom instruction, parents' and students' perceptions of the metric system, and the interpersonal relationship of school personnel as it relates to metric instruction.

Curriculum workers need to recognize that if perceptions of metric change are influenced by readiness to change and barriers to metric change, then teachers' attitudes toward the metric system must be modified if they are to perceive fewer barriers to metric change and become more ready to change. Teachers then become dependent on the curriculum workers to help provide an environment conducive to change and relatively free of barriers

to change. Such an environment could be supported and initiated by not only curriculum workers, but also by school boards, school administrators, universities, and the individual teachers. This environment must be one of acceptance, support, and understanding concerning the difficulty of any major curriculum revision.

It would then seem imperative that teachers perceive curriculum workers in a positive light, one that is not threatening and that permits a free sharing of common concerns. Perhaps the curriculum workers must first change the way they work with teachers when they plan initiation of metric systems as the sole unit of measure in the classroom. If teachers' behavior is the result of their perceptions, the curriculum worker should avoid becoming a barrier to metric change and should instead help teachers eliminate barriers. All metric inservice, metric workshops, and metric seminars should be structured to include these issues. Principals in the schools should consider inservice as an effective means of bringing about changes in teacher attitudes and in curriculum. As can be seen from this study, inservice has a positive effect on readiness to change and reduces the number of internal and external barriers to metric change. This also might be true for other content areas. Principals should consider inservice when planning budgets so change can be effected.

The data from this study would also suggest that males are more ready to change to the metric system than females. Males perceive fewer internal barriers to metric change while perceiving training as less of a barrier. The curriculum worker should take this into consideration when planning metric workshops, metric inservice, or metric seminars.

The purpose of this study as stated in Chapter I was to determine what teachers perceive as barriers to metric change, to determine the varying degrees of readiness to change and barriers to metric change as it relates to selected demographic variables. In the process of completing this study, certain questions remain unanswered and should be considered for further research.

1. What are the factors affecting a teacher's knowledge of the metric system? This would be useful in planning metric workshops, metric inservice, and metric seminars.
2. Teachers change when they know how to change. What are the specific factors that lead to change?
3. Which attitudes about the metric system can be modified quickly? Which attitudes will need to be modified over time?
4. Which barriers to metric change are real and which are imaginary?

5. What is the elementary teacher's current understanding of metric measurement? How committed are teachers to the metric system?
6. What information about teachers is necessary for the curriculum workers to know in order to conduct the technical aspects of metric inservice?
7. Which type of metric instruction would be most valuable to elementary teachers and which is most effective in overcoming the barriers to metric change?
8. A study should be undertaken that could establish a cause and effect relationship between readiness to change and participation in metric workshops, metric inservice, or metric seminars. Are teachers more ready to change because they have participated in metric workshops, metric inservice, or metric seminars, or do they participate because they were more ready to change?

APPENDICES

APPENDIX A

APPENDIX A

PILOT STUDY

The pilot study was conducted in the summer of 1976 at Michigan State University. The sample was a group of graduate students enrolled in Education 881 - Workshop: Teaching Mathematics Grades Kindergarten Through Six.

The purpose of the pilot study was to test administration procedures using the Readiness to Change Scale and the instrument developed by the researcher and to have a group of participants react to the questionnaire.

The results of the pilot study are somewhat inconclusive due to the small number of participants as well as the limited analysis of the data.

The limited findings of the pilot study are presented in the following manner: First, Table A1 describes the characteristics of the sample: age, sex, and teaching level. Table A2 describes the characteristics of the sample: highest degree held, experience, and participation in metric workshops, metric inservice, and metric seminars. Finally, the results of the analysis are discussed following a statement of the null

TABLE A1

CHARACTERISTICS OF THE SAMPLE
AGE, SEX, AND TEACHING LEVEL

Characteristic	Frequency Observed	Percentage Observed
Age		
20-29 years	28	77.8
30-39	8	22.2
40-49	--	----
50 and above	--	----
TOTAL	36	100.00
Sex		
Male	6	16.7
Female	30	83.3
TOTAL	36	100.00
Teaching Level		
K	4	11.1
1	3	8.3
2	3	8.3
3	3	8.3
4	7	19.4
5	6	16.7
6	6	16.7
Other	4	11.1
TOTAL	36	100.00

TABLE A2

CHARACTERISTICS OF THE SAMPLE: HIGHEST DEGREE HELD, EXPERIENCE, AND PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, AND METRIC SEMINARS

Characteristic	Frequency Observed	Percentage Observed
Degree Held		
B.A.	30	83.3
M.A.	6	16.7
Doctorate	--	----
TOTAL	36	100.0
Experience		
<1-4 years	22	61.1
5-9	11	30.6
10-14	1	2.8
15-19	2	5.6
≥20	--	----
TOTAL	36	100.0
Participation in Metric Workshops, Metric Inservice, and Metric Seminars		
Yes	9	25.0
No	27	75.0
TOTAL	36	100.0

hypothesis. Statistically significant findings are denoted by an asterisk. Each table follows a brief discussion of the findings.

Null Hypothesis I. *There is no relationship between scores on the Readiness to Change Scale and the number of total barriers teachers perceive to metric change.*

Null Hypothesis Ia. *There is no relationship between scores on the Readiness to Change Scale and the number of internal barriers teachers perceive to metric change.*

Null Hypothesis Ib. *There is no relationship between scores on the Readiness to Change Scale and the number of external barriers teachers perceive to metric change.*

Null Hypothesis Ic. *No differences exist between the number of internal or external barriers to metric change perceived by teachers who exhibit a greater readiness to change.*

The results of the data presented in Table A3 are somewhat inconclusive, since a complete analysis was not done of null hypothesis I, Ia, Ib, and Ic. However, the Pearson Product-Moment Correlations are in the predicted direction. Teachers who are more ready to change perceive fewer total barriers, internal barriers, and external barriers to metric change. The less a teacher was ready to change, the more external barriers as compared to internal barriers were perceived. Even though the correlations are in the predicted direction, the

strength of the correlations do not warrant rejection of null hypotheses I, Ia, Ib, or Ic.

TABLE A3

CORRELATIONS BETWEEN SCORES ON THE READINESS TO CHANGE SCALE AND THE NUMBER OF TOTAL BARRIERS, INTERNAL BARRIERS, AND EXTERNAL BARRIERS PERCEIVED

Variable	r	Statistic
Total Barriers	.31	N = 36
Internal Barriers	.27	d.f. = 34
External Barriers	.29	r = 33

A. Age

Null Hypothesis 1a. *No relationship exists between scores on the Readiness to Change Scale and teacher's age.*

Null Hypothesis 2a. *No relationship exists between perceived internal barriers to metric change and teacher's age.*

Null Hypothesis 3a. *No relationship exists between perceived external barriers to metric change and teacher's age.*

The results displayed in Table A4 indicate that a relationship does exist between age and readiness to change, perceived internal barriers, and perceived external barriers. The direction of the Pearson Product-Moment Correlations indicate that older teachers are less ready to change than younger teachers. Older

teachers also perceive more internal and external barriers to metric change. However, the strength of the Pearson Product-Moment Correlation does not warrant the rejection of null hypotheses 1a, 2a, or 3a.

TABLE A4

CORRELATIONS BETWEEN AGE AND SCORES ON THE READINESS TO CHANGE SCALE, PERCEIVED INTERNAL BARRIERS, AND PERCEIVED EXTERNAL BARRIERS

Variable	r	Statistic
Readiness to Change	-.12	N = 36
Internal Barriers	-.19	d.f. = 34
External Barriers	-.30	r = .32

B. Sex

Null Hypothesis 1b. *No differences exist between male teachers' scores on the Readiness to Change Scale and female teachers' scores on the Readiness to Change Scale.*

The results of the analysis presented in Table A5 indicate that no significant difference exists between sex and scores on the Readiness to Change Scale. The null hypothesis is not rejected.

TABLE A5

RELATIONSHIP BETWEEN MALE AND FEMALE TEACHERS ON THE READINESS TO CHANGE SCALE

	Male	Female	df	t	p
N:	6	30	34	-.30	.76
M:	2.50	2.59			
SD:	.52	.69			

Null Hypothesis 2b. *No differences exist between the number of internal barriers perceived by male teachers and the number of internal barriers perceived by female teachers.*

From the data presented in Table A6, it is apparent that there is no significant difference between the number of internal barriers to metric change perceived by male teachers and the number of internal barriers to metric change perceived by female teachers. The null hypothesis is not rejected. These results are somewhat contradictory to the results in the main study.

TABLE A6

RELATIONSHIP BETWEEN MALE AND FEMALE TEACHERS AND INTERNAL BARRIERS TO METRIC CHANGE

	Male	Female	df	t	p
N:	6	30	34	-.61	.54
M:	1.94	2.19			
SD:	.54	.94			

Null Hypothesis 3b. *No differences exist between the number of external barriers perceived by male teachers and the number of external barriers perceived by female teachers.*

According to the findings in Table A7, no significant difference exists regarding sex and the number of external barriers perceived to metric change. However, it would seem that males perceive fewer external barriers to metric change than females, and that this difference could occur by chance sixty-three times in one hundred. This level is not sufficient to reject the null hypothesis.

TABLE A7

RELATIONSHIP BETWEEN MALE AND FEMALE TEACHERS AND EXTERNAL BARRIERS TO METRIC CHANGE

	Male	Female	df	t	p
N:	6	30	34	-.47	.63
M:	2.48	2.56			
SD:	.97	.42			

C. Degree Held

Null Hypothesis 1c. *No relationship exists between professional education training and scores on the Readiness to Change Scale.*

The results displayed in Table A8 indicate that there is a relationship between education training and scores on the Readiness to Change Scale. The strength of the relationship is sufficient to reject the null hypothesis. Teachers with more professional education training had more favorable scores on the Readiness to Change Scale.

TABLE A8

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATION TRAINING AND A HIGH SCORE ON THE READINESS TO CHANGE SCALE

	B.A.	M.A.	df	t	p
N:	30	6			
M:	2.69	2.00	34	2.48	.01*
SD:	.62	.63			

Null Hypothesis 2c. *No relationship exists between professional education training and the number of perceived internal barriers to metric change.*

The results of the analysis shown in Table A9 indicate that no significant relationship exists between degrees held by teachers and number of perceived internal barriers to metric change. The observed results could occur by chance eighty-five times in one hundred. This observed statistical significance level is not sufficient to reject the null hypothesis.

TABLE A9

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATIONAL TRAINING AND INTERNAL BARRIERS TO METRIC CHANGE

	B.A.	M.A.	df	t	p
N:	30	6			
M:	2.16	2.08	34	.57	.85
SD:	.87	1.04			

Null Hypothesis 3c. *No relationship exists between professional education training and the number of perceived external barriers to metric change.*

The results displayed in Table A10 indicate that no relationship was observed between degrees held by teachers and the number of perceived external barriers to metric change. The null hypothesis was not rejected.

TABLE A10

RELATIONSHIP BETWEEN PROFESSIONAL EDUCATION TRAINING AND INTERNAL BARRIERS TO METRIC CHANGE

	B.A.	M.A.	df	t	p
N:	30	6			
M:	2.54	2.59	34	.81	.79
SD:	.40	.40			

D. Teaching Experience

Null Hypothesis 1d. *No relationship exists between teaching experience and scores on the Readiness to Change Scale.*

Null Hypothesis 2d. *No relationship exists between teaching experience and the number of perceived internal barriers to metric change.*

Null Hypothesis 3d. *No relationship exists between teaching experience and the number of perceived external barriers to metric change.*

Significant relationships do not exist between age and scores on the Readiness to Change Scale, number of perceived internal or external barriers. The Pearson Product-Moment Correlations displayed in Table All do indicate direction. Teachers with less teaching experience have a more favorable score on the Readiness to Change Scale, and also perceive fewer internal and external barriers to metric change. Even though direction is indicated, the strength of the correlations are not sufficient to reject null hypotheses 1d, 2d, or 3d.

TABLE All

CORRELATIONS BETWEEN TEACHING EXPERIENCE AND SCORES ON THE READINESS TO CHANGE SCALE, INTERNAL BARRIERS, AND EXTERNAL BARRIERS

Variable	r	Statistic
Readiness to Change	-.1232	N = 36
Internal Barriers	-.1986	d.f. = 34
External Barriers	-.3089	r = .32

E. Participation in Metric Workshops, Metric Inservice, or Metric Seminars

Null Hypothesis 1e. *No differences exist between scores on the Readiness to Change Scale for teachers who have participated in metric workshops, metric inservice, or metric seminars and scores on the Readiness to Change Scale for teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

According to the findings indicated in Table A12, no significant differences exist between mean scores on the Readiness to Change Scale and participation in metric workshops, metric inservice, or metric seminars at the .05 level of significance. The null hypothesis is not rejected.

TABLE A12

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND SCORES ON THE READINESS TO CHANGE SCALE

	Participation	Non-Participation	df	t	p
N:	9	27			
M:	2.75	2.74	34	.34	.97
SD:	.81	.69			

Null Hypothesis 2e. *No differences exist between the number of perceived internal barriers to metric change by teachers who have participated in metric workshops, metric inservice, or metric seminars and the number of perceived internal barriers to metric change by teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

Differences are apparent, in Table A13, in the number of perceived internal barriers and participation in metric workshops, metric inservice, and metric seminars. Having participated in a metric worshop, metric inservice, or metric seminar does influence the number of perceived internal barriers to metric change. Based on this data, the null hypothesis is rejected.

TABLE A13

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND INTERNAL BARRIERS TO METRIC CHANGE

	Participation	Non-Participation	df	t	p
N:	9	27			
M:	1.64	2.31	34	-2.06	.04*
SD:	.64	.89			

Null Hypothesis 3e. *No differences exist between the number of perceived external barriers by teachers to metric change who have participated in metric workshops, metric inservice, or metric seminars and the number of external barriers to metric change perceived by teachers who have not participated in metric workshops, metric inservice, or metric seminars.*

According to the analysis of the data presented in Table A14, a significant relationship does exist between teachers who have participated in metric workshops, metric inservice, or metric seminars and the number of external barriers to metric change perceived by teachers. Those teachers who have participated in metric workshops, metric inservice, or metric seminars perceived fewer external barriers to metric change than teachers who have not participated. The observed statistical significance level is sufficient to reject the null hypothesis.

TABLE A14

RELATIONSHIP BETWEEN PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS AND EXTERNAL BARRIERS TO METRIC CHANGE

	Participation	Non-Participation	df	t	p
N:	9	27			
M:	2.34	2.62	34	-2.03	.04*
SD:	.37	.39			

Summary

The purpose of the pilot study was to test administration procedures using the Readiness to Change Scale and the instrument developed by the researcher, and to give the researcher some feel for the data and possible analysis techniques.

The analysis of the data in the pilot study was not as indepth as the main study resulting in inconclusive findings on many of the hypotheses. However, the researcher found the pilot study valuable as a tool for becoming familiar with the data in the main study.

TABLE A15

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE NINE-ITEM READINESS TO CHANGE SCALE ON THE PILOT STUDY

Statement	Correlation
1	.0190
2	.3890
3	.4757
4	.5039
5	.2180
6	.4473
7	.5518
8	.3890
9	.5483

Alpha for 9-item scale = .6833

TABLE A16

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE EIGHT-ITEM READINESS TO CHANGE SCALE ON THE PILOT STUDY

Statement	Correlation
2	.4013
3	.5157
4	.5139
5	.2189
6	.4637
7	.5713
8	.4562
9	.5667

Alpha for 8-item scale = .730

TABLE A17

DESCRIPTIVE MEASURES OF THE MAJOR VARIABLES IN THE PILOT STUDY

Variable	N	Minimum	Maximum	Mean	S.D.
Total Barriers	36	1.5	4.0	2.4	.54
Readiness to Change	36	1.0	3.7	2.5	.66
Internal Barriers	36	1.0	4.7	2.15	.88
External Barriers	36	1.7	3.6	2.5	.40

TABLE A18

DESCRIPTIVE MEASURES OF THE DEMOGRAPHIC VARIABLES IN THE PILOT STUDY

Variable	N	Minimum	Maximum	Mean	S.D.
Years	36	2.00	9.00	5.08	1.90
Grade	36	1.00	9.00	5.00	2.39
Degree	36	1.00	2.00	1.16	.37
Sex	36	1.00	2.00	1.83	.37
Age	36	1.00	5.00	2.36	1.17
Participation	36	1.00	2.00	1.75	.43

TABLE A19

DESCRIPTIVE MEASURES OF EACH STATEMENT
IN THE PILOT STUDY

Statement	N	Minimum	Maximum	Mean	S.D.
1	36	1.0000	5.0000	4.1111	1.2824
2	36	1.0000	5.0000	2.6389	1.1748
3	36	1.0000	5.0000	2.3611	1.1748
4	36	1.0000	5.0000	2.9167	1.3810
5	36	1.0000	5.0000	2.6111	1.0764
6	37	1.0000	5.0000	2.7222	1.2331
7	36	1.0000	5.0000	2.7222	1.1859
8	36	1.0000	5.0000	1.8889	1.0896
9	36	1.0000	4.0000	2.7500	.6036
10	36	1.0000	5.0000	3.0278	1.3833
11	36	1.0000	5.0000	2.2222	1.2674
12	36	1.0000	5.0000	2.8889	1.3686
13	36	1.0000	5.0000	2.4444	1.3190
14	36	1.0000	5.0000	1.9722	1.1335
15	36	1.0000	5.0000	3.2778	1.3440
16	36	2.0000	5.0000	3.2778	.7411
17	36	1.0000	5.0000	2.6111	1.3581
18	36	2.0000	5.0000	3.0278	.7741
19	36	1.0000	5.0000	3.0833	1.2734
20	36	1.0000	5.0000	2.1111	1.2370
21	36	1.0000	5.0000	2.1667	1.1832
22	36	1.0000	5.0000	2.2500	1.2507
23	36	1.0000	5.0000	3.1111	1.3262
24	36	1.0000	5.0000	2.3333	1.2189
25	36	1.0000	4.0000	2.2222	.9292
26	36	1.0000	5.0000	2.5278	1.4830
27	36	1.0000	5.0000	3.0556	1.1450

Table A19 continued

Statement	N	Minimum	Maximum	Mean	S.D.
28	36	1.0000	5.0000	2.3611	1.2225
29	36	1.0000	5.0000	2.3333	1.2873
30	36	1.0000	5.0000	2.6111	1.1027
31	36	1.0000	5.0000	1.6667	1.1952
32	36	1.0000	5.0000	1.8611	1.0994
33	36	1.0000	5.0000	2.0556	1.0126
34	36	1.0000	5.0000	3.3333	1.3310
35	36	1.0000	5.0000	2.0833	1.1052
36	36	1.0000	5.0000	3.1111	1.3475
37	36	1.0000	5.0000	1.9722	1.2068
38	36	1.0000	4.0000	1.6944	.9202
39	36	1.0000	5.0000	2.8333	1.0000
40	36	1.0000	5.0000	1.7500	1.0790
41	36	1.0000	5.0000	1.5833	.9673
42	36	1.0000	5.0000	1.7500	1.0247
43	36	1.0000	5.0000	3.8056	1.0907
44	36	1.0000	5.0000	1.7222	1.0586
45	36	1.0000	5.0000	1.7222	1.0586
46	36	1.0000	5.0000	2.2222	1.3755
47	36	1.0000	4.0000	1.7500	.9673
48	36	1.0000	5.0000	2.3611	1.0462
49	36	1.0000	4.0000	2.3889	.9645
50	36	1.0000	5.0000	2.1389	1.3342
51	36	1.0000	5.0000	2.5000	1.4243

APPENDIX B

APPENDIX B

ADDITIONAL TABLES

TABLE B1

DESCRIPTIVE MEASURES OF THE MAJOR VARIABLES IN THE MAIN STUDY

Variable	N	Minimum	Maximum	Mean	S.D.
Total Barriers	149	1.42	4.06	2.6	.57
Readiness to Change	153	1.12	4.62	2.9	.75
Internal Barriers	150	1.00	4.06	2.4	.78
External Barriers	151	1.59	4.26	2.8	.53

TABLE B2

DESCRIPTIVE MEASURES OF THE DEMOGRAPHIC VARIABLES IN THE MAIN STUDY

Variable	N	Minimum	Maximum	Mean	S.D.
Years	153	1.00	10.00	8.29	1.66
Grade	153	1.00	9.00	3.70	2.37
Degree	153	1.00	2.00	1.49	.50
Sex	153	1.00	2.00	1.86	.33
Age	152	1.00	9.00	5.24	2.15
Participation	153	1.00	2.00	1.46	.50

TABLE B3

DESCRIPTIVE MEASURES OF EACH QUESTION
IN THE MAIN STUDY

Statement	N	Minimum	Maximum	Mean	S.D.
1	151	1.0000	5.0000	3.8079	1.3452
2	153	1.0000	5.0000	3.4510	1.3521
3	153	1.0000	5.0000	3.1895	1.3066
4	150	1.0000	5.0000	3.5267	1.3546
5	151	1.0000	5.0000	2.5629	1.2032
6	154	1.0000	5.0000	3.1429	1.3354
7	153	1.0000	5.0000	2.6601	1.2094
8	152	1.0000	5.0000	2.3092	1.3531
9	144	1.0000	5.0000	2.8819	.6946
10	150	1.0000	5.0000	2.9533	1.3125
11	151	1.0000	5.0000	2.3113	1.1383
12	152	1.0000	5.0000	3.9474	1.2168
13	154	1.0000	5.0000	3.8766	1.3002
14	153	1.0000	5.0000	2.2484	1.1372
15	152	1.0000	5.0000	3.0197	1.1593
16	151	1.0000	5.0000	3.1788	1.1436
17	152	1.0000	5.0000	2.7434	1.3690
18	147	1.0000	5.0000	3.0884	.9431
19	146	1.0000	5.0000	3.1164	1.2006
20	153	1.0000	5.0000	2.5948	1.3399
21	152	1.0000	5.0000	2.1579	1.1572
22	153	1.0000	5.0000	2.4902	1.2624
23	152	1.0000	5.0000	3.7303	1.3809
24	150	1.0000	5.0000	2.2333	1.3129
25	150	1.0000	5.0000	2.1267	1.2168
26	152	1.0000	5.0000	3.1118	1.4261
27	150	1.0000	5.0000	3.5867	1.1939

Table B3 continued

Statement	N	Minimum	Maximum	Mean	S.D.
28	149	1.0000	5.0000	2.6174	1.2335
29	151	1.0000	5.0000	2.3974	1.2225
30	150	1.0000	5.0000	2.6333	1.2607
31	150	1.0000	5.0000	2.1067	1.1594
32	150	1.0000	5.0000	2.2933	1.3389
33	149	1.0000	5.0000	2.6443	1.3660
34	149	1.0000	5.0000	2.6644	1.3487
35	149	1.0000	5.0000	2.9195	1.5091
36	151	1.0000	5.0000	3.2053	1.3629
37	149	1.0000	5.0000	2.4564	1.2600
38	151	1.0000	5.0000	2.1722	1.1987
39	149	1.0000	5.0000	3.3020	1.2176
40	149	1.0000	5.0000	2.3490	1.2836
41	149	1.0000	5.0000	2.1678	1.2270
42	151	1.0000	5.0000	1.6424	.8820
43	144	1.0000	5.0000	3.5694	1.1924
44	146	1.0000	5.0000	1.9315	1.0482
45	148	1.0000	5.0000	2.2500	1.2392
46	151	1.0000	5.0000	2.3245	1.2938
47	151	1.0000	5.0000	2.4371	1.3345
48	151	1.0000	5.0000	2.3642	1.1105
49	151	1.0000	5.0000	2.5563	1.1292
50	151	1.0000	5.0000	2.5563	1.2994
51	152	1.0000	5.0000	2.9408	1.2982

TABLE B4

DESCRIPTIVE MEASURES OF THE RESPONSES OF EACH QUESTION IN THE MAIN STUDY

Statement	N	Miss	Responses (1)	(2)	(3)	(4)	(5)
1	151	3	7	30	21	20	73
			4.6%	19.9%	13.9%	13.2%	48.3%
2	153	1	17	25	27	40	44
			11.1%	16.3%	17.6%	26.1%	28.8%
3	153	1	23	23	35	46	26
			15.0%	15.0%	22.9%	30.1%	17.0%
4	150	4	15	23	30	32	50
			10.0%	15.3%	20.0%	21.3%	33.3%
5	151	3	39	28	55	18	11
			25.8%	18.5%	36.4%	11.9%	7.3%
6	154	0	23	28	37	36	30
			14.9%	18.2%	24.0%	23.4%	19.5%
7	153	1	28	52	27	36	10
			18.3%	34.0§	17.6%	23.5%	6.5%
8	152	2	62	26	34	15	15
			40.8%	17.1%	22.4%	9.9%	9.9%
9	144	10	9	16	103	15	1
			6.3%	11.1%	71.5%	10.4%	.7%
10	150	4	30	17	58	20	25
			20.0%	11.3%	38.7%	13.3%	16.7%
11	151	3	44	45	41	13	8
			29.1%	29.8%	27.2%	8.6%	5.3%
12	152	2	5	25	11	43	68
			3.3%	16.4%	7.2%	28.3%	44.7%
13	154	0	13	15	17	42	67
			8.4%	9.7%	11.0%	27.3%	43.5%

Table B4 continued

Statement	N	Miss	Responses (1)	(2)	(3)	(4)	(5)
14	153	1	51 33.3%	38 24.8%	47 30.7%	9 5.9%	8 5.2%
15	152	2	19 12.5%	22 14.5%	69 45.4%	21 13.8%	21 13.8%
16	151	3	12 7.9%	24 15.9%	67 44.4%	21 13.9%	27 17.9%
17	152	2	37 24.3%	34 22.4%	33 21.7%	27 17.8%	21 13.8%
18	147	7	9 6.1%	13 8.8%	100 68.0%	6 4.1%	19 12.9%
19	146	8	18 12.3%	17 11.6%	67 45.9%	18 12.3%	26 17.8%
20	153	1	43 28.1%	38 24.8%	23 15.0%	36 23.5%	13 8.5%
21	152	2	66 43.4%	15 9.9%	58 38.2%	7 4.6%	6 3.9%
22	153	1	49 32.0%	24 15.7%	45 29.4%	26 17.0%	9 5.9%
23	152	2	13 8.6%	23 15.1%	23 15.1%	26 17.1%	27 44.1%
24	150	4	60 40.0%	37 24.7%	24 16.0%	16 10.7%	13 8.7%
25	150	4	67 44.7%	21 14.0%	49 32.7%	2 1.3%	11 7.3%
26	152	2	32 21.1%	22 14.5%	23 15.1%	47 30.9%	28 18.4%
27	150	4	12 21.1%	9 14.5%	51 15.1%	35 30.9%	43 18.4%

Table B4 continued

Statement	N	Miss	Responses (1)	(2)	(3)	(4)	(5)
28	149	5	38 25.5%	29 19.5%	43 28.9%	30 20.1%	9 6.0%
29	151	3	50 33.1%	29 19.2%	40 26.5%	26 17.2%	6 4.0%
30	150	4	40 26.7%	22 14.7%	55 36.7%	19 12.7%	14 9.3%
31	150	4	65 43.3%	28 18.7%	37 24.7%	16 10.7%	4 2.7%
32	150	4	64 42.7%	21 14.0%	33 22.0%	21 14.0%	11 7.3%
33	149	5	43 28.9%	29 19.5%	31 20.8%	30 20.1%	16 10.7%
34	149	5	40 26.8%	30 20.1%	37 24.8%	24 16.1%	18 12.1%
35	149	5	40 26.8%	20 13.4%	36 24.2%	18 12.1%	35 23.5%
36	151	3	24 15.9%	24 15.9%	31 20.5%	41 27.2%	31 20.5%
37	149	5	47 31.5%	30 20.1%	38 25.5%	25 16.8%	9 6.0%
38	151	3	60 39.7%	33 21.9%	39 25.8%	10 6.6%	9 6.0%
39	149	5	17 11.4%	13 8.7%	57 38.3%	32 21.5%	30 20.1%
40	149	5	55 36.9%	29 19.5%	31 20.8%	26 17.4%	8 5.4%
41	149	5	63 42.3%	30 20.1%	30 20.1%	20 13.4%	6 4.0%

Table B4 continued

Statement	N	Miss	Responses (1)	(2)	(3)	(4)	(5)
42	151	3	86 57.0%	39 25.8%	23 15.2%	3 2.0%	
43	144	10	9 6.3%	13 9.0%	53 36.8%	25 17.4%	44 30.6%
44	146	8	69 47.3%	31 21.2%	36 24.7%	7 4.8%	3 2.1%
45	148	6	59 39.9%	27 18.2%	34 23.0%	22 14.9%	6 4.1%
46	151	3	49 32.5%	48 31.8%	26 17.2%	12 7.9%	16 10.6%
47	151	3	50 33.1%	35 23.2%	31 20.5%	20 13.2%	15 9.9%
48	151	3	47 31.1%	25 16.6%	61 40.4%	13 8.6%	5 3.3%
49	151	3	39 25.8%	19 12.6%	71 47.0%	14 9.3%	8 5.3%
50	151	3	48 31.8%	22 14.6%	39 25.8%	33 21.9%	9 6.0%
51	152	2	29 19.1%	27 17.8%	38 25.0%	40 26.3%	18 11.8%

TABLE B5

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE INTERNAL BARRIERS TO METRIC CHANGE

Statement	Correlation
11	0.4728
14	0.5305
20	0.5819
22	0.5093
26	0.4949
28	0.7262
29	0.6954
31	0.6095
36	0.6383
37	0.6880
41	0.4627
44	0.4802
45	0.6668
46	0.3423
51	0.5200

TABLE B6

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE EXTERNAL BARRIERS TO METRIC CHANGE

Statement	Correlation
10	0.3291
12	0.1623
13	0.2731
15	0.1964
16	0.3351
17	0.4938
18	0.3029
19	0.3282
21	0.4239
23	0.3405
24	0.1008
25	0.2430
27	0.1832
30	0.4994
32	0.6420
33	0.6001
34	0.2831
35	0.5057
38	0.5165
39	0.3508
40	0.5396
42	0.0532
43	0.1286
47	0.5762
48	0.4566
49	0.4845
50	0.2720

TABLE B7

CRONBACH'S ALPHA INTER-ITEM CORRELATION FOR THE TOTAL BARRIERS TO METRIC CHANGE

Statement	Correlation
10	0.4322
11	0.6198
12	0.5013
13	0.4272
14	0.4316
15	0.6991
16	0.6090
17	0.5789
18	0.5421
19	0.6634
20	0.5998
21	0.5387
22	0.7071
23	0.2187
24	0.5241
25	0.2945
26	0.1429
27	0.2483
28	0.1564
29	0.2611
30	0.4444

Table B7 continued

Statement	Correlation
31	0.2325
32	0.2720
33	0.2506
34	0.3275
35	0.0462
36	0.2334
37	0.1644
38	0.5510
39	0.6654
40	0.6259
41	0.4077
42	0.5347
43	0.5369
44	0.3207
45	0.5707
46	0.0888
47	0.1561
48	0.5649
49	0.4990
50	0.4777
51	0.4230

TABLE B8

AN ANALYSIS OF THE TOTAL BARRIERS TO METRIC CHANGE AND SEX CHARACTERISTICS

	Male	Female	df	t	p
N:	20	128			
M:	2.52	2.72	146	-2.24	.02*
SD:	.47	.57			

TABLE B9

AN ANALYSIS OF THE TOTAL BARRIERS TO METRIC CHANGE AND PROFESSIONAL EDUCATION TRAINING

	B.A.	M.A.	df	t	p
N:	73	75			
M:	2.64	2.72	146	.75	.45
SD:	.46	.57			

TABLE B10

AN ANALYSIS OF THE TOTAL BARRIERS TO METRIC CHANGE AND PARTICIPATION IN METRIC WORKSHOPS, METRIC INSERVICE, OR METRIC SEMINARS

	Participation	Non-Participation	df	t	p
N:	79	69			
M:	2.52	2.87	146	-3.83	.00*
SD:	.50	.59			

APPENDIX C

APPENDIX C

QUESTIONNAIRE

Directions for Administering Questionnaire

Questionnaire should be administered during a regular staff meeting and should be incorporated as a part of the meeting.

All questionnaires should be completed and returned during the staff meeting. Fifteen minutes should be scheduled for completion of questionnaire.

I. Read purpose of the study to the participants.

Purpose:
1) To determine what teachers in grades K-5 perceive as barriers to metric change.
2) To determine the varying degrees of readiness to change to the metric system.
3) To determine the relationship of selected demographic variables toward metric change.

II. Read directions to the participants.

The items in this questionnaire are all related, in varying degrees, to metric change. The method to be used in working through this project is to first consider your experiences in metric; then, with this in mind, consider each item on the questionnaire. Please do not overlook any items.

Read each question carefully and respond truthfully and thoughtfully.

All responses to this questionnaire will be kept in the strictest confidence. No effort will be made to isolate any one questionnaire for an evaluation. DO NOT SIGN YOUR NAME. Please do not discuss these items until everyone has finished the questionnaire.

When you have answered all questions, place the questionnaire in the envelope provided. The envelope will be sealed after all questionnaires are returned and placed in the U.S. mail.

Thank you for your cooperation.

Directions for Completing the Questionnaire

The questionnaire attached is one of 160 that teachers in the Jackson Public Schools are completing. Its purpose is to attempt to discern what a large group of teachers perceive as barriers to metric change.

The items in this questionnaire are all related, in varying degrees, to metric change. The method to be used in working through this project is to first consider your experiences in metric; then, with this in mind, consider each item on the questionnaire. Please do not overlook any items.

All responses to this questionnaire will be kept in the strictest confidence. No effort will be made to isolate any one questionnaire for an evaluation. DO NOT SIGN YOUR NAME. Please do not discuss these items until everyone has finished the questionnaire.

A copy of the results of the study will be sent to the Jackson Public Schools for inclusion in their professional files.

Thank you for your cooperation.

Clifford P. Weber

1. How many years have you been teaching?

   Less than one _____ 1 _____ 2 _____ 3 _____

   4 _____ 5-9 _____ 10-14 _____ 15-19 _____

   20 or more _____

2. At what grade level do you teach?

   K _____ 1 _____ 2 _____ 3 _____ 4 _____

   5 _____ 6 _____ Other _____

3. What is the highest academic degree you now hold?

   Bachelor's _____ Master's _____

   Doctorate _____ Other _____

4. What is your sex?

   Male _____ Female _____

5. What was your age at your last birthday?

   20-24 _____ 25-29 _____ 30-34 _____

   35-39 _____ 40-44 _____ 45-49 _____

   50-54 _____ 55-59 _____ 60 or more _____

6. Have you participated in a metric workshop, metric inservice, or metric seminar?

   Yes _____ No _____

QUESTIONNAIRE	I strongly agree	I agree a little	I neither agree nor disagree	I disagree a little	I strongly disagree
1. If I could do as I pleased, every few months I would change the kind of work I do.					
2. One can never feel at ease on a job where the ways of doing things are always being changed.					
3. The trouble with teaching is that you just get used to doing things one way and then they want you to do them differently.					
4. I would prefer to keep my present assignment which I know I can handle than to change to one where most things would be new to me.					
5. The trouble with many people is that when they find a job they can do well they don't stick with it.					
6. I like a job where I know that I will be doing my work about the same way from one week to the next.					
7. When I get used to doing things in one way it is disturbing to have to change to a new method.					
8. It would take a sizable raise in pay for me to accept a different assignment here.					

	Is always the same	Changes very little	Changes somewhat	Changes quite a bit	Changes a great deal
9. The job that you would consider ideal for you would be one where the way you do your work . . .					

	I strongly agree	I agree a little	I neither agree nor disagree	I disagree a little	I strongly disagree
10. I feel that I would not receive strong support from my superiors if I attempted to teach only metric measurement and did not teach English measurements.					
11. I am optimistic about teaching metric.					
12. The individual teacher is rarely consulted when the curriculum is being changed.					
13. I can't make the change in teaching to metric until the school provides sufficient supplies and materials.					
14. I become upset with those who suggest that I change and teach metric now.					
15. Other teachers have helped me as I work with the metric system.					

	I strongly agree	I agree a little	I neither agree nor disagree	I disagree a little	I strongly disagree
16. The board of education is sincere about trying to help the teachers change to metric.					
17. I have enough time to teach those things in the metric system that the student must know.					
18. The superintendent is concerned about the instructional problems of the metric system in the schools.					
19. The schools have enough money for metric education.					
20. I would feel secure in teaching the metric system to my students.					
21. If I taught the metric system instead of the current English system other teachers would be critical of me.					
22. I feel discouraged in my attempt to learn the metric system.					
23. I have the materials I need with which to teach the metric system effectively.					
24. Faculty meetings in which metric education is discussed would be of value to me.					

	I strongly agree	I agree a little	I neither agree nor disagree	I disagree a little	I strongly disagree
25. The principal does not support efforts to teach the metric system.					
26. I feel that I am knowledgeable enough about the metric system to teach it.					
27. The curriculum workers in our school district do not understand the true picture of how things are in the classroom.					
28. When I try to teach the metric system I feel frustrated.					
29. I lack the self confidence necessary to help my students to learn the metric system.					
30. The people who plan and make the metric curriculum expect too much of the classroom teacher.					
31. I hesitate to teach the metric system because I fear failure.					
32. A teacher can't be expected to do a good job of teaching the metric system and still fulfill all the other tasks expected of him/her.					
33. I do not feel that I can attempt to teach metric when the students' work in the other areas is behind that of other classes.					

	I strongly agree	I agree a little	I neither agree nor disagree	I disagree a little	I strongly disagree
34. I feel that my educational training is adequate for the kind of teaching I plan to do in the metric system.					
35. You can't expect a teacher to teach the metric system when there are more than 30 pupils in a class.					
36. I do not have enough experiences in the metric system to do the kind of teaching I would like to do.					
37. I seem to lack the enthusiasm to try and teach my students about the metric system.					
38. Only those teachers who teach math and science should teach the metric system to the students.					
39. There is a lack of good source books on the metric system.					
40. It is a waste of time teaching the students about the metric system when most of them don't care and see no purpose in it.					
41. At this time I do not see a purpose in teaching about the metric system.					
42. I would use films on the metric system if they were available when I wanted to use them.					

	I strongly agree	I agree a little	I neither agree nor disagree	I disagree a little	I strongly disagree
43. There is no agreed upon curriculum on metric education in our school.					
44. My personality is not suited for a new curriculum in the metric system.					
45. I seem to lack the incentive I need to do a good job of teaching metric.					
46. I understand the underlying principles of the metric system.					
47. There is no need to teach the metric system because the students are not yet able to use it in everyday life experiences.					
48. The inservice education I have experienced has only frustrated my efforts to learn and teach the metric system.					
49. Lack of cooperation from parents makes it difficult to teach the metric system.					
50. The metric system is difficult to learn.					
51. I do not know many meaningful activities involving use of the metric system.					

TO BE USED IN YOUR STAFF BULLETIN IF DESIRED

Participation in a Metric Study

Jackson Public Schools, grades K-5 have been chosen as participants in a metric education study from Michigan State University. This will only involve 15 minutes of your time as our part of the study will be to complete a short questionnaire.

In accordance with the Master Agreement, participation is voluntary; however, I urge you to participate as metric education is becoming increasingly important in the elementary schools.

At our next staff meeting, 15 minutes will be devoted to distribution and completion of the questionnaire.

Jackson Public Schools will also receive copies of the study for our use in future planning of metric education.

APPENDIX D

APPENDIX D

LETTER SENT TO DR. BRUCE MITCHELL, DR. LOREN WOODBY, AND DR. WILLIAM FITZGERALD

June 22, 1976

Dear

I sincerely appreciate your time and expertise in helping me finalize my questionnaire for use in my dissertation. I am asking three Michigan State professors to criticize the questionnaire. Guidelines for the criticism are:

1. Are the statements clear? Do you understand them well enough to respond to them?
2. Do the statements reflect, in your opinion, barriers to metric change?

For your convenience the questions have been separated into two categories: those reflecting internal barriers and those reflecting external barriers. The questionnaire will use a five-point Lickert-type scale to measure the degree of agreement or disagreement to each of the statements.

I realize the difficulty in arranging a meeting at this time of year and for that reason I am enclosing a stamped, self-addressed envelope for you to return your comments to me. I would appreciate your returning them before July 5, so that I may carry out my pilot study during the five-week summer term.

Sincerely,

Clifford P. Weber

STATEMENTS THAT REFLECT EXTERNAL BARRIERS

1. I feel that I would receive strong support from my superiors if I attempted to teach only metric measurement and did not teach English measurement.

2. The individual teacher is rarely consulted when the curriculum is being changed.

3. I can't make the change in teaching to metric until the school provides sufficient supplies and materials.

4. Other teachers have helped me as I work with the metric system.

5. The board of education is sincere about trying to help the teachers change to metric.

6. I have enough time to teach those things in the metric system that the student must know.

7. The superintendent is concerned about the instructional problems of the metric system in the schools.

8. The schools have enough money for metric education if the money was spent more wisely.

9. The principal does not support any effort to teach the metric system.

10. I have all the materials I need with which to teach the metric system effectively.

11. Faculty meetings in which metric education is discussed would be of value to me.

12. If I taught the metric system instead of the current English system other teachers would be critical of me.

13. The curriculum workers in our school district do not understand the true picture of how things are in the classroom.

14. The people who plan the metric curriculum have a lot of unrealistic ideas.

15. A teacher can't be expected to do a good job of teaching the metric system and still fulfill all the other tasks expected of him/her.

16. I do not feel that I can attempt to teach metric when the students' work in the other areas is behind that of other classes.

17. You can't expect a teacher to teach the metric system when there are 30 pupils in a class.

18. Only those teachers who teach math and science should teach the metric system to the students.

19. There is a lack of good textbooks on the metric system.

20. It is a waste of time teaching the students about the metric system when most of them don't care and see no purpose in it.

21. I would use films on the metric system if they were available when I wanted them.

22. There is no agreed upon curriculum of metric education in our school.

23. With all the time that teaching consumes, teachers should not be expected to be able to keep up with the new trends.

24. There is no need to teach the metric system because the students are not yet able to use it in every day life experiences.

25. Parents don't like the metric system, so we should down-play its importance in the schools.

26. The inservice education I have experienced has only frustrated my efforts to learn and teach the metric system.

STATEMENTS THAT REFLECT INTERNAL BARRIERS

1. I am optimistic about teaching metric.

2. I feel hostile to those who suggest that I change and teach metric now.

3. I would feel secure in teaching the metric system to my students.

4. I feel discouraged in my attempt to learn the metric system.

5. I could help students read a map that had a metric scale rather than an English scale.

6. I feel that I am not knowledgeable enough about the metric system to teach it in the manner in which I would like.

7. When I try to teach the metric system I feel frustrated.

8. I lack the self confidence necessary to help my students learn the metric system.

9. I feel that my educational training is adequate for the kind of teaching I plan to do in the metric system.

10. I seem to lack the enthusiasm to try and teach my students the metric system.

11. At this time I do not see a purpose in teaching the metric system.

12. My personality is not suited for a new curriculum in the metric system.

13. I seem to lack the incentive I need to do a good job of teaching metric.

14. I understand the underlying principles of the metric system.

15. I hesitate to teach the metric system because I fear failure.

16. I do not have enough experiences in the metric system to do the kind of teaching I would like to do.

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