AN ABSTRACT OF THE THESIS OF

Tendekai Don Makande for the degree of Doctor of Philosophy in Education presented on December 6, 1989.

Title: A Study to Determine the Need for Mathematics Inservice Training for Untrained and Trained Teachers in K-7 Rural Schools in Manicaland, Zimbabwe

Abstract approved: Redacted for Privacy
Dr. Ed Strowbridge /

The purpose of this study was to determine the need for mathematics inservice training for untrained and trained teachers in K-7 rural schools in Manicaland, Zimbabwe. The auxiliary teachers do not have any professional preparation before entry into the teaching profession. The study sought to determine the mathematics areas needed most by the primary school teachers during inservice training to improve the quality of mathematics instruction in their schools.

A 28-item questionnaire was employed to measure the mathematics inservice needs of 120 teachers in grades 1-7. Six general areas were identified: mathematics knowledge, mathematics curriculum, mathematics training for teachers, instructional strategies, inservice training, the concept

of rural education, and updated information from the field of mathematics education. Respondents were asked to indicate the extent of their perception of need for improvement in each of the 28 items on the questionnaire. The questionnaires were also designed to obtain the following information from K-7 teachers: demographic information which included personal information, professional education, experience, and perceptions of needs to improve mathematics instruction in K-7 rural schools in Manicaland, Zimbabwe.

Information obtained from 120 returned questionnaires (100%) was tabulated, and the data were examined using descriptive statistics: frequencies and percentages of responses to each item, individual scores of the groups were described, and Pearson Product Moment Correlation was utilized to compute the degree of relationship between items. In addition the t-test was used to determine if there was a significant difference between the means of the two groups.

Within the limitations of the study the following major conclusions were drawn.

1. Inservice teachers have a strong interest in the improvement of mathematics teaching in K-7 schools in rural Manicaland.
2. Mathematics inservice programs and workshops should stress both content of mathematics and methods.

3. The teachers expressed the need for training in the following areas:

   i) mathematics content;

   ii) instructional strategies;

   iii) use of teaching aids, such as computers and calculators; and

   iv) curriculum development.

A STUDY TO DETERMINE THE NEED FOR MATHEMATICS INSERVICE TRAINING FOR UNTRAINED AND TRAINED TEACHERS IN K-7 RURAL SCHOOLS IN MANICALAND, ZIMBABWE

by

Tendekai Don Makande

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Completed December 6, 1989

Commencement June 1990

APPROVED:

Redacted for Privacy

Professor of Educational Foundations in charge of major

Redacted for Privacy

Chair of the Department of Curriculum and Instruction

Redacted for Privacy

Dean of School of Education

Redacted for Privacy

Dean of Graduate School

Date thesis is presented December 6, 1989

Typed by Harvey McCloud for Tendekai Don Makande

DEDICATION

I dedicate this thesis to the Makande Family.

ACKNOWLEDGEMENTS

I want to express my sincere gratitude to my major professor, Dr. Ed Strowbridge, whose constant support, encouragement and very helpful attitude made this research possible and very enjoyable. I would also like to thank him for his many helpful suggestions and contributions to the research and writing of this thesis.

I would also like to thank the members of my committee, Dr. V. Utz, Dr. D. Simmons, Dr. C. Wood, Dr. R. Northam and Dr. P. Wells, the graduate representative.

Acknowledgement must be made to these people that had to bear the burden of association through years of trial, doubt and accomplishment.

Special recognition goes to my family members in Zimbabwe and brother Daniel (M.D.) in Michigan and Edgar (B.Sc., G.M.) in Zimbabwe for financial support and continuous encouragement throughout my academic career. It is a great pity that my mother died before the completion of my doctoral program. I would also like to extend gratitude to Dr. A. Sana of the Ministry of Education for his help in collecting data from the primary school teachers in Zimbabwe. And finally, my sincere thanks to Don T., the real force behind this study being completed.

TABLE OF CONTENTS

Chapter		Page
I	INTRODUCTION	1
	Background	1
	Statement of the Problem	3
	Purpose of the Study	3
	Objectives of the Study	4
	Significance of the Study	4
	Research Hypotheses	5
	Assumptions of the Study	6
	Limitations of the Study	6
	Definition of Terms	7
II	REVIEW OF RELATED LITERATURE	9
	The Concept of Rural Education	10
	Inservice Training	13
	Mathematics Knowledge for Teachers	17
	Mathematics Teacher Training	24
	Curriculum Development	29
	Instructional Strategies	31
	Contemporary Information from the Field of Mathematics Education	33
	Summary	35
III	METHODS AND PROCEDURES	36
	The Instrument	37
	Reliability and Validity	37
	Population and Sample	40
	Collection of Data	41
	Data Analysis	41
	Level of Reliability	42
IV	PRESENTATION AND ANALYSIS OF DATA	43
	Description of Teacher Sample	44
	Personal Information Survey	46
	Summary of Pearson Product Moment	47
	The Six Variables of the Study	49
	Descriptive Statistics	50
	Statistics	54
	Teachers' Responses to Twenty-eight Competency Items	55
	Untrained Teachers' Responses to Twenty-eight Competency Items	58
	Trained Teachers' Responses to Twenty-eight Competency Items	60
	Comparison of Teachers' Responses to the Twenty-eight Items in the Instrument	62

Responses of Headmasters to Open-ended Questions 63
Headmasters' Recommendations 64
Summary 66

V SUMMARY, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS 67
Summary and Findings 67
Conclusions 69
Discussion 70
Recommendations for Further Research 73
Inservice Mathematics Education Program 75

BIBLIOGRAPHY 77

APPENDICES 82
APPENDIX A 82
Letter of Request to Conduct a Study in Selected K-7 Schools in Manicaland 83
Letter of Permission to Conduct a Study in Selected K-7 Schools in Manicaland 84
The Survey Instruments and Accompanying Letter to the Respondents 85

APPENDIX B 94
Supplementary Tables 94
Distribution of Untrained Teachers by Sex ... 95
Distribution of Untrained Teachers According to Marital Status 96
Distribution of Trained Teachers by Sex 97
Distribution of Trained Teachers According to Marital Status 98
Distribution of Headmasters by Sex 99
Distribution of Headmasters by Age 100
Distribution of Headmasters According to Their Marital Status 101

LIST OF TABLES

Table		Page
1.	Summary of the Results of the Correlation Test for the Reliability of the Questionnaire	38
2.	Item Construction Table	40
3.	Correlation Value Table	42
4.	Frequency Distribution of Age among 120 Responding Teachers	45
5.	Frequency Distribution of Marital Status among 120 Responding Teachers	45
6.	Summary of the Demographic Information/Training in the Investigation	46
7.	Correlation of Inservice Training Needs between Trained and Untrained Teachers	47
8.	Mean Values of Types of Inservice Training	49
9.	Variable One: Mathematics Inservice Training	50
10.	Variable Two: Subject Matter Knowledge	51
11.	Variable Three: Curriculum	52
12.	Variable Four: Classroom or Teaching Strategies .	53
13.	Variable Five: Instructional Materials	53
14.	Variable Six: Updated Information in the Field of Mathematics Education	54
15.	Teachers' Responses to Twenty-eight Competency Items	56
16.	Description of Untrained Teachers' Responses to Twenty-eight Competency Items	59
17.	Description of Trained Teachers' Responses to Twenty-eight Competency Items	61
18.	Additional Needs of Teachers	64
19.	Weaknesses of Untrained Teachers as Perceived by Responding Headmasters	65

20. Headmasters' Recommendations 65

21. Summary of Some of the Discussed Results 73

22. Distribution of Untrained Teachers by Sex 95

23. Distribution of Untrained Teachers According to Marital Status 96

24. Distribution of Trained Teachers by Sex 97

25. Distribution of Trained Teachers According to Marital Status 98

26. Distribution of Headmasters by Sex 99

27. Distribution of Headmasters by Age 100

28. Distribution of Headmasters According to Marital Status 101

A STUDY TO DETERMINE THE NEED FOR MATHEMATICS INSERVICE TRAINING FOR UNTRAINED AND TRAINED TEACHERS IN K-7 RURAL SCHOOLS IN MANICALAND, ZIMBABWE

CHAPTER I

INTRODUCTION

Background

The primary school teacher in Zimbabwe is intended to be a highly specialized professional. Adequate preparation requires training beyond any preparation program in existence today. Ideally such preparation requires instruction in content, curriculum and pedagogy for science, social science, mathematics, language, reading, art, music and physical education.

The importance of teachers in the education of any society is widely acknowledged. The development of any nation depends on the quality of its teachers. Much of the criticism today about falling standards places blame on teachers. In 1981 the Committee on Undergraduate Programs in Mathematics (C.U.P.M.) urged teacher educators to increase the number of mathematics courses in elementary education training programs in order to improve basic knowledge of mathematics.

UNESCO (1974) reported that many developing countries have an acute shortage of teachers. A large number of those who teach do not have any type of professional

preparation. Some individuals are deficient even in general academic education.

The teaching force in Zimbabwe is made up of people with various backgrounds. This is most prevalent in the schools located in rural areas, where the policy appears to be to provide adult supervisors in the classroom instead of qualified teachers.

The General Certificate of Education/Cambridge School Certificate Examination results (1981-86) published by the Ministry of Eduction, Harare, indicated that more than 45% of untrained teachers did not pass mathematics in their secondary school education. Mathematics records of primary school teachers are even less impressive; consequently, it would appear that inservice training is both a possible and a desirable approach to help to upgrade the performance of these teachers so that they can meet the continuously changing needs and aspirations of students. The National Research Council (NRC) stated that

> Mathematics is the key to opportunity. No longer just the language of science, mathematics now contributes in direct and fundamental ways to business, finance, health and defense. For students, it opens doors to careers. For citizens, it enables informed decisions. For nations, it provides knowledge to compete in a technological economy. To participate fully in the world of the future, America must tap the power of mathematics (1989, p.1).

Statement of the Problem

The purpose of this study was to determine the need for and type of mathematics inservice training for untrained and trained teachers in K-7 rural schools in Manicaland, Zimbabwe. Both knowledge and skills in mathematics and level of pedagogical preparation were included in the research.

This study also attempted to identify alternative ways of approaching mathematics primary teacher training for rural untrained and trained teachers in Manicaland, Zimbabwe.

To examine the selected factors related to mathematics inservice education, five demographic variables were identified:

a) Teacher's gender

b) Years of teaching experience

c) Highest academic training attained

d) Teacher's age

e) Marital status

Purpose of the Study

The purpose of this study was to determine the need for and type of mathematics inservice training for untrained and trained teachers in K-7 rural schools in Manicaland, Zimbabwe.

Objectives of the Study

The objectives of the study were:

1) To investigate the need for mathematics inservice training for K-7 rural school teachers regarding the topics of a) mathematics inservice training, b) content knowledge, c) curriculum, d) classroom strategies, e) instructional materials, and f) updated information from the field of mathematics education.
2) To determine the scheduling of the time the teachers will need to have inservice training to improve the quality of mathematics instruction in their schools.

Significance of the Study

The Ministry of Education in Zimbabwe has many policies and statements concerning the training of teachers in Zimbabwe. The government considers the education of teachers to be very important to the country. The government wants all teachers to be properly trained and continue to grow on the job, but resources are lacking to meet growing demands.

There is little in the literature of mathematics teacher education in Zimbabwe about alternative ways of

training teachers of mathematics on the job. This study will have specific application to teacher-training programs by providing data which will aid in:

1) Developing new programs for pre-service and inservice teachers of mathematics in K-7 rural schools in Zimbabwe.
2) Identify need areas in the field of mathematics education.

Research Hypotheses

This study was designed to investigate the need for mathematics inservice training for untrained and trained teachers in K-7 rural schools of Manicaland, Zimbabwe. The following hypotheses were constructed for research purposes:

1) Ho: $U_A = U_B = U_C$

   There is no significant difference between the mean scores of teachers on mathematics content knowledge and teaching aids.

2) There is no significant difference in what is needed in terms of elementary mathematics inservice training between the schools.

Assumptions of the Study

The study was based on the following assumptions:

1) The need for mathematics inservice education for untrained and trained teachers can be reliably measured by questionnaires validated by a selected group of K-7 teachers in Zimbabwe and a Delphi panel. The Ministry of Education administers the total system of primary and secondary education.
2) The type of mathematics inservice education for teachers can be reliably assessed by the questionnaire validated by a selected group of K-7 school teachers in Zimbabwe and a Delphi panel.
3) All teachers will respond appropriately regarding their status as primary school teachers during data collection.

Limitations of the Study

This study was limited in the following ways:

1) The teachers were sampled from rural schools in Manicaland, Zimbabwe.
2) The primary school teachers ranged from grade 1 to grade 7 level.
3) Teacher educators, supervisors, and officials from the Ministry of Education were excluded from the investigation.

Definition of Terms

Inservice Education: This represents any planned program of learning opportunities afforded staff members of schools, colleges or other educational agencies for purposes of improving the performance of the individual in already assigned positions.

Rural School: A public school located in the countryside or in a village where there is a general lack of opportunities and services. Rural schools in this study are described in the context of developing countries.

Elementary Education: This describes the period of formal schooling in Zimbabwe given in an institution for children between the ages of six years and thirteen years.

Auxiliary Teacher: This term is used to refer to any teacher at the elementary level who does not posseses the T_3 teacher's certificate.

Time for Inservice Training: This term refers to the days the primary school teachers of mathematics in Manicaland, Zimbabwe prefer to do inservice training during the year.

Teaching Method: Any instructional method used by the classroom teacher.

Curriculum Development: Any technique used to plan scope and/or sequence in an elementary school mathematics program.

General Certificate of Education/Cambridge School Certificate: The diploma or certificate awarded to students who have successfully completed four years of secondary education.

T3: This is the diploma awarded to students who have successfully completed three years of training as an elementary school teacher at a teacher training institution.

T2: This is the diploma awarded to students who have successfully completed two years of training at a training institution and can teach in junior high schools and at times in elementary schools.

J.C.: The diploma or certificate awarded to students who have successfully completed two years of secondary education.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents a review of the literature dealing with mathematics inservice training for the untrained and trained teachers in K-7 rural schools in Manicaland, Zimbabwe.

Several avenues of research must be explored in order to understand the literature surrounding mathematics inservice education. This chapter presents a review of the literature dealing with 1) the concept of rural education, 2) mathematics inservice training, 3) mathematics teacher training: curriculum and instructional strategies, 4) mathematics knowledge required for teachers, 5) instructional strategies, and 6) updated information from the field of mathematics education. The investigator is concerned with the quality of mathematics instruction at the elementary level of education in rural Manicaland, Zimbabwe. The study aims at formulating recommendations for an on-the-job mathematics training programs for K-7 teachers.

Related literature in this study comes, therefore, not only from Zimbabwe but from numerous studies which involved the training of teachers who teach mathematics in rural environments. Educational Resource Information Centre (ERIC) and Library Information Retrieval Service (LIRS) indicated that research from Zimbabwe regarding this topic of study is either limited or nonexistent. Data from U.S.

schools was used and was applied to those areas of concern in which a good degree of similarity was identified.

The Concept of Rural Education

In 1958, Archer stated that rural education is the education provided for people who live on farms and in villages and even small towns.

The major purpose of education for rural children and youth is not the mere imparting of literacy and regimen of certain information and skills, but rather to achieve and sustain a desirable level of cultural, ethical and economic living; the rural schools, or those that service a rural constituency, ought to be institutions whose programs are indigenous to the needs and experiences of the pupils and communities served (Department of Rural Education, 1955).

Fort (1918) explained that "It is undeniably true that the professional schools in charge of the preparation of teachers and our general educational leadership have been slow to recognize the need of specific training for rural schools."

Rural education serves the people who live in the rural areas. In Zimbabwe both rural and urban schools are expected to perform equally. There is not much difference between rural and urban schools in terms of educational performance. Zimbabwe has a national system of education (Ministry of Education, 1983).

Oberholtzer (1934) suggested that

> A comprehensive program of education must be complete enough to provide for all youth the type of education which will enable them to realize maximum individual growth and self development; as well as to insure social well-being and progress through the entire learning period.

Thus according to Oberholtzer, differentiation in programs of education is not necessary. Rural and urban schools should follow the same program.

Tamblyn (1960) pointed out that the primary challenge in rural education is to drastically improve the quality of its educational offerings and make it as relevant for those who will remain in the community as for those who will migrate to urban areas.

Many developing countries today see education and schools as the major vehicles of development. However, many developing countries forget the rural portions of their countries. Consequently, rural schools and education become impoverished. Rural education should be both literary and vocational to make the rural population as viable as their urban counterparts. In Zimbabwe, rural schools are generally of low quality in terms of the buildings and surroundings. The majority of the teachers who occupy these rural schools are untrained. Few trained teachers with skills and competence take up positions in rural areas. Many rural schools were destroyed during the civil war of 1972-1980 (Ministry of Education, 1983), and as a result, families migrated from rural areas to the

urban centers, leaving behind ruined and destroyed schools with no qualified personnel to run them. Also, many trained teachers prefer to work in urban areas than to work in rural areas. The system seems to favor the urban teachers and to forget or isolate rural teachers. The teacher training programs in Zimbabwe fail to take into account the conditions that a teacher who teaches in a rural school will have to face. Everett Edington (1973) and his colleagues linked the problem of quality of teachers in rural schools with the isolation of rural areas from the center of activities. Chase and Baker (1952) described rural teachers as more poorly trained and more poorly paid than their urban colleagues, that working conditions are unattractive to keep and retain qualified teachers, and teachers in rural areas are poorly prepared in terms of understanding the rural sociology. Such conditions are very evident in the contemporary rural schools of Zimbabwe.

One strong possibility remaining for the rural, underqualified, untrained teachers to grow on the job is through inservice education, because one of the purposes of teacher education in Zimbabwe is to help teachers fit into the social life of the community and society at large and to enhance their commitment to national objectives. The investigator believes that mathematics instruction in the rural areas will only improve if the government encourages

inservice education for all teachers in K-7 schools. Pankratz (1975) points out that field-based training centers in rural areas are necessary to provide pre-service and in-service teacher education to meet the needs of rural youth. Turner (1978) and Wofford (1952) believe that teachers and rural communities will benefit educationally if colleges in urban areas play a role with rural communities and teachers in the improvement of the quality of instruction in the schools.

Inservice Training

In-service education, like any other kind of education, has to do with helping teachers and school personnel grow, learn, think and improve instruction in the K-7 schools.

In 1980, Luke stated that the concept of inservice education for continued professional development, or as an extension of pre-service teacher training, embraces a host of complex and overlapping ideas.

A definition of inservice is described by Luke as "learning that takes place after formal, undergraduate teacher preparation has been completed; or as learning on-the-job or learning - while earning" (p. 9).

According to Harris and Bessent (1969), inservice education is described as planned activities for the instructional improvement of professional staff members.

Harris (1980) stated that inservice education is any planned learning opportunities provided to personnel of the local district or other authorized agency for purposes of improving the performance of such personnel in already held or assigned positions.

In 1963, Moffit stated that, "Regardless of the quantity and quality of academic education received in a college or university, a teacher new to any given school system needs in-service education." Moffit (1963) stressed that teaching is learning and much of it tends to be repeated until it becomes a habit and that proper education of the nation's teachers is and should be the concern of every citizen.

Orange and Rye (1975) stated that inservice education was planned to upgrade the competencies, knowledge, skills and attitudes required by school personnel in the performances of assigned goals or duties. Siedow, Memory and Bristow (1985) stated that successful inservice programs are most likely to result from training which addresses the individual needs of participants.

Gene Bottoms (1975) suggested three purposes of inservice teacher education, namely:

1) to implement education/improvement activities directed toward specified student needs;
2) to improve their own or expected goals of professional development, which may or may

not lead to higher levels of certification; and

3) to meet their own goals of personal growth.

Harris and Bissent (1969) argue that the pre-service preparation of professional staff members is rarely ideal and may be primarily an introduction to professional preparation rather than professional preparation as such.

After review of related research on the mathematics backgrounds of primary school teachers, Sparks stressed that elementary teachers of mathematics were considered by many authors to be

1) deficient in understanding of underlying principles,
2) deficient in computational skills, and
3) deficient in problem solving ability.

(1961, pp. 395-403)

Houston (1967) stressed that it is important for the teachers of mathematics to

1) know mathematics adequately,
2) be familiar with a wide variety of instructional strategies,
3) understand the psychological and sociological influences on children,
4) be able to diagnose pupil learning needs, and
5) have a positive attitude toward mathematics.

Inservice education is, therefore, essential to enable teachers to keep abreast with what is going on in the changing educational scene of today.

C.U.P.M. (1961) recommended that every teacher admitted to an elementary education program should be made to take one year's study of real number system, a half year of intuitive geometry and a half year of algebra.

Dienes notes that

> ... the fact that mathematics is found difficult or unpleasant or both by so many people testifies to the existence of real learning difficulties. The curious fact is that these difficulties have never been systematically or scientifically studied, and consequently our knowledge of the process of learning mathematics is so scanty as to hardly amount to knowledge at all. (1963, p. 24)

Suvapunt (1980) realized that local teacher training colleges should persuade K-7 school teachers both untrained and trained to come back to the training colleges or universities and enroll in mathematics content and methods courses, since it is necessary for them to learn more rather than asking for help from their mathematics pupils whom they teach. Rubin (1971) stated that inservice training is there to help the teacher become progressively more sensitive to what is happening in his classroom and to support his efforts to improve on what he is doing.

Inservice education can be very helpful especially to the rural teachers who live and work in disadvantaged environments. Inservice education can help rural teachers grow on the job and learn new and challenging things in the

areas of science and mathematics. Rural teachers need to be current in the field of elementary mathematics teaching. The United Nations Educational, Scientific and Cultural Organization (1974) reported that 60% of the world's population live in a rural environment. Many children in the world attend rural schools, and a majority of the teachers in rural areas are underqualified and are not knowledgeable, especially in the areas of mathematics and science. Inservice education is the only vehicle that can help alleviate some of the teachers' problems in rural schools.

Mathematics Knowledge for Teachers

To be a good teacher of primary school mathematics it is necessary to know a good deal of mathematics. A primary school teacher must be able to interpret and supplement the text, answer offbeat mathematical questions, guide students into productive patterns of thought by asking appropriate questions, offer insights and illuminating examples, exhibit a genuine enthusiasm for the subject, challenge the strong, and devise alternative strategies for teaching the weak. To do any of these things requires an understanding of mathematics that goes well beyond grade level. It is very unfortunate that many primary schools in rural Manicaland are occupied by teachers who have very limited mathematics knowledge (Ministry of Education, 1983). As an elementary school teacher it will, of course, be important

that they be able to solve problems. How they solve them also will be important.

Krause (1978) pointed out that more and more mathematics educators are beginning to agree that the future teacher should be able to look at arithmetic from three viewpoints:

1) external meanings, where all the symbols have concrete references in the real world (this is where mathematics is born and where it returns in applications);
2) algorithms, where the symbols are manipulated in mechanical, well-rehearsed ways; and
3) mathematics systems, where the internal harmony and basic simplicity of each mathematical structure is perceived.

Krause (1978) stressed that there was no royal road to anywhere. To understand mathematics one must do mathematics.

Riedesel and Callahan (1977) indicated three basic ideas:

1) mathematics as a system of thought, a search for patterns;
2) mathematics as a vehicle for the solution of problems of the real "world"; and
3) mathematics as a self-fulfilling venture of the mind.

These three views should be understood and appreciated by the teacher.

Teacher training colleges, universities and other institutions of higher learning can be used as sources for teacher improvement. Non-qualified teachers in rural areas appear to have no idea of what happens in the heads of their pupils. Half of these nonqualified teachers in rural Manicaland themselves have a primary education or even less. Educators wonder how the children are going to perform in mathematics when the teachers themselves can not comprehend elementary mathematics. Knowledge of mathematics and learning theory are important (Houston, 1967).

Teachers of mathematics in primary schools (K-7) must be encouraged through inservice training to grasp the concept of basic skills in mathematics. Problem solving is one aspect that is very crucial to all teachers of mathematics because learning to solve problems is the principal reason for studying mathematics.

Aichele (1978) said that a recent study by Johnson and Byars clearly indicates that much progress has been made by institutions of higher learning in meeting Committee on Undergraduate Programs in Mathematics (CUPM) recommendations, and supports a call for more coursework in probability and statistics, computer science, geometry, and applications.

The related literature consistently indicates that inservice education is necessary in order to retrain teachers of mathematics and science which may be extended to the situation in the K-7 rural schools of Manicaland, Zimbabwe. Furthermore, mathematics inservice education for teachers can help them keep abreast with what is going on in this changing world of high technology and science. Skills in problem solving, application and analysis are very important to the practicing teacher of mathematics.

The American Association for the Advancement of Science Cooperative Committee on the Teaching of Science and Mathematics (1960) recommended that prospective teachers should take six semester hours in mathematics and recommended an additional four semester hours in a fifth year program.

The National Science Association (1961) in Planning for Excellence in High School Science, noted the importance of a rich subject matter preparation program for science teachers. The Association presented the idea that the teacher can teach both content and process more effectively if the teacher is adequately prepared in the subject field.

> With proper mastery of content and an understanding of the role that content plays in science education, the flexibility and value of the teacher thus is enhanced. A teacher can enjoy the confidence of being able to pursue whatever direction student interest or the dictates of the moment may lead him; and he can effectively participate in the dynamic process of curriculum building. If the science teacher is to with equal facility both the process and product goals of

> Science, he must himself experience these concepts in the science courses comprising his pre-service training (pp. 62-63).

Researchers have reported conflicting findings from the studies dealing with teacher preparation and student achievement in the field of science. Bloom (1963) stated that

> Research on teaching must, in most cases, make use of measures of cognitive achievement to determine whether the teaching method, instructional procedures, or the teacher does produce changes in the learners (p. 379).

Marcus (1975) carried out a study about the relationship between the academic mathematical background of the teachers and the mathematical achievement of the students from grades 3-8. The principal purpose of the study was to determine how much the following 10 teacher variables of current and previous mathematics teachers influenced the mathematics achievement of students at grade levels three through eight. The teacher variables examined were:

a) sex,

b) ethnicity,

c) age,

d) number of semester hours in mathematics,

e) number of semester hours in mathematics education,

f) number of semester hours in Education,

g) number of semester hours in Science,

h) number of years of classroom teaching experience,

i) number of high school mathematics credits, and

j) grade point average.

Six hundred students were chosen from the junior high schools. The students were chosen because they had been in the school district continuously from grades two to eight and nine. Three hundred fifty teachers had taught these children since grade two.

Scores for the Iowa Test of Basic Skills, the short form of the Academic Aptitude Test, and the Comprehensive Test of Basic Skills were obtained since grade three from the students' cumulative folders. The mathematics achievement of children seemed to have been influenced very little by the academic background of teachers as defined by the 10 variables under investigation. A variable of current and previous teachers contributed less than 2% of the variance in current total mathematical achievement. The study assumes that hours of course work and grade point averages are positively related to teacher knowledge. Grade point averages may not have measured knowledge gained.

The National Council of Teachers of Mathematics (1980) stated that

> the schools are faced with a widespread shortage of qualified mathematics teachers. The demand for mathematical competence in many sectors of society is great and growing, and schools find it impossible to compete for individuals who have this desired background. Thus in many mathematics classrooms the teacher does not have the subject matter qualifications for teaching mathematics.

The report went on to say that every mathematics teacher should accept responsibility for maintaining teacher competence. The National Council of Teachers of Mathematics (1980) stated that:

1) Full advantage should be taken of all existing opportunities for continuing education.
2) Teachers should insist that school districts and colleges make provisions for in-service education and staff development opportunities.
3) Teachers should belong to professional organizations that are dedicated to the improvement of teaching and learning.
4) Teachers should participate actively in the efforts of professional organizations to improve teaching and learning.
5) Teachers should share ideas and participate with their peers in co-operative efforts at self-improvement, including observation and constructive criticism of one another.
6) Teachers as a profession should insist that all members maintain a consistently high standard of professional behavior. The profession is not obligated to protect those individuals who refuse to live up to reasonable professional standards.
7) Bargaining units of organizations representing teachers should include in their request release

time for professional development and attendance at professional conferences that provide in-service education.

Mathematics Teacher Training

It is very difficult to find trained teachers in rural Africa, let alone Zimbabwe. The political and social structure of Zimbabwe has a tremendous influence on the schools and on teacher training.

There is a movement to have all primary school teachers in Zimbabwe certified, that is to require professional educational training. This change will be very slow, particularly in mathematics and sciences, because of two factors. First, there is an acute shortage of mathematics and science teachers and secondly, there is a shortage of training facilities.

Before 1970 most teachers were certified to teach only after spending two years in the secondary school and two years in a teacher training college. The present requirements for certification are

1) three years at a training college after four years of secondary schooling, and
2) three years of study at a teacher's college plus one extra year of study in the school of education at the university.

Teachers going through program two (2) usually have academic records superior to those going through program (1).

Not all teachers can get this training. Inservice training is the only way out for the poor teachers in rural Zimbabwe.

Flener (1986) described the comments of some educators who summarized the qualities of effective inservice programs by stating,

> the best (inservice) system will be those in which a collegial atmosphere is developed within the school so that teachers continuously study their (own) teaching in ways which meet their needs, continuously reflect on the products of their study, and continuously are provided follow-ups to the study in their own classroom.

Kanengiser (1985) explained that the Council for Basic Education had released a report indicating that thousands of educators are teaching courses for which they lack proper certification, and that this was hurting the quality of instruction in U.S.A. schools. The report went on to say, "The most damaging consequence of out-field assignment is its negative impact on the quality of and the education students receive."

The Ministry of Education (1983) stated that mathematics has become a major instructional thrust in the schools of Zimbabwe and many other developing countries. Zimbabwe needs better trained mathematics teachers, and inservice education is the only means for increasing teacher effectiveness.

Maybury (1975) noted that

> ... The most pressing problem is the teacher of science. He needs academic and professional preparation so that he may develop a sound and reasonable philosophy of science teaching.

Tazi (1980) explained that

> ... teacher training should be planned in the context of lifelong education and should be given not only before but also during employment. In this process of continuing education, inservice training is becoming particularly important owing to the rapidly changing nature of all subjects taught and the general explosion of knowledge.

Aichele (1978) stressed that teacher education in mathematics must place emphasis in the following areas:

1) the development of process abilities, that is abilities in logical reasoning and problem solving, and methods of developing these abilities in children;
2) development of teacher judgmental abilities to make intelligent decisions about curricular issues in the face of growing outside pressure for fads and uniformed policy;
3) recognition that skills of statistical inference and the ability to deal intelligently with collections of information are among the essential minimal skills required by every person in today's world;
4) appreciation of the uses and applications of mathematics in the solution of "real world" problems;

5) development of skills in teaching the effective use of computing and calculating machines in solving problems;

6) for grades 8-12 teachers, literacy in at least one problem solving programming computer language and grasp of the issues in computer literacy; and

7) preparation of new teachers to enter realistically the existing school system as well as to participate in emerging trends.

The Oregon Department of Education (1989) stressed the curriculum goals for K-7 mathematics in the following areas:

1) number and numeration;

2) appropriate computational skills;

3) problem solving;

4) geometry and visualization skills;

5) measurement;

6) statistics and probability;

7) mathematical relationships;

8) oral and written communication; and

9) appropriate study skills.

Several research studies in mathematics education indicate that practical mathematics training for teachers is very essential. Again, related literature consistently indicates that many teachers who teach mathematics in our

schools lack the mathematical skills that are needed to sustain the technological advanced society. Mathematics inservice education will help teachers teach practical mathematics and not be limited by rigid memorization and rote learning. The National Research Council (NRC) (1989) reported that students are dangerously unprepared in mathematics. Mathematics inservice education can help teachers see the need for stronger emphasis on problem solving and fundamental concepts and more use of calculators and computers.

Again, inservice education can be used to show teachers that the curricula must be structured around basic mathematical concepts -- shape, chance, change, dimension and quantity, for example -- that run through every level of mathematics education from grade one to university. The main objective would be to help students understand and apply mathematics skills to practical problems.

It is important for teachers, parents, and school administrators to develop positive attitudes to mathematics, since attitudes, positive or negative, determine the way a person reacts to the environment, and positive attitudes tend to be more productive than negative attitudes. The development of positive attitudes must be a primary goal in teacher training (Dirocco, 1978).

Curriculum Development

The National Research Council (NRC) (1989) reported that mathematics is one way we make sense of things and that it enables us to perceive patterns, to comprehend data, and to reason carefully. Mathematics curricula at all levels must introduce more of the breadth and power of the mathematical sciences. To prepare students to use mathematics in the twenty-first century, today's curriculum must invoke the full spectrum of the mathematical sciences.

Lerch (1970) emphasized that mathematics inservice programs were important because they provide an orderly, planned basis for implementing the mathematics curriculum and for working toward its improvement. Most primary school teachers in rural environments will benefit from inservice education that would provide them with the required skills they lack.

Bruner noted that

> A body of knowledge is the result of much intellectual activity. To instruct someone in these disciplines is not a matter of getting him to commit results to mind. Rather it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as a historian does, to take part in the process of knowledge getting. Knowledge is a process, not a product. (1966, p. 72)

Mathematics curricula should be developed in such a way as to make students think mathematically for them-

selves. Elementary school is where children learn mathematical skills needed for daily life. The major objective of elementary school mathematics should be to develop number sense. Like common sense, number sense produces good and useful results with the least amount of effort. Mathematics curriculum development should provide for continuous inservice training of mathematics teachers in both math content and methods of mathematics instruction. Alpren (1967) stated that the teacher, as the individual directly responsible for instruction, must be versed in mathematical concepts; no longer can an elementary school teacher be ignorant of mathematics.

Numerical operations are no longer the main aim of the elementary school program. In order fully to realize the objectives of the curriculum, the teacher must be knowledgeable in the field of mathematics and also be energetic and enthusiastic in his presentation.

The National Council of Teachers of Mathematics (1989) warns that American students are dangerously unprepared in mathematics and has outlined an ambitious plan to revamp mathematics education that calls for

1) less rote learning,
2) emphasis on problem solving,
3) fundamental concepts, and
4) greater use of calculators and computers.

The National Council of Teachers of Mathematics (1989) stressed that they would establish teaching standards for every grade, rewrite curricula and reconsider the current division of the subject into arithmetic, algebra and geometry and other distinct courses.

The NRC (1989) reported that the major objective of curricula change in mathematics is to help the students understand and apply math skills to practical problems. Math education, the report said,

> is an enterprise rooted in antiquity, with some of today's curricula matching very closely educational patterns of 500 years ago. Yet ... mathematics education has entered a period of significant change certain to last well into the next century.

The Corvallis Gazette-Times (1989) reported that American mathematics pupils badly trail those in Japan and Hong Kong largely because of unchallenging and pointlessly repetitious school curricula. The newspaper stressed that the National Council of Teachers of Mathematics calls for radical changes in the content and teaching of pre-college mathematics. Rigorous drill and rote learning are out, and problem solving is in.

Instructional Strategies

Instructional strategies are any procedures used in the classroom by the teacher to make the teaching process

more meaningful and interesting to the children. Teaching must become more professional.

The National Research Council (1989) reported that in most schools mathematics continues to be primarily a passive activity. Teachers prescribe, students transcribe.

In his research, Abshire (1973) reported that more than 66% of teachers in southwestern Louisiana had no graduate semester hours in mathematics content courses. He further pointed out that slightly less than 75% had no graduate semester hours in mathematics teaching methods and that more than 50% of the respondents employed a whole class instructional approach in teaching mathematics. Abshire also stated that the respondents indicated demonstration lessons as the most beneficial inservice program.

The Committee on Undergraduate Programs in Mathematics (CUPM) (1981) urged teacher educators to increase the number of mathematics courses in elementary education training programs.

Dossey (1981) pointed out that

> ... if children are to earn a living in this new world they must understand mathematics more deeply than any other generation had to (1981, p. 24-26).

Commenting about the performance of elementary school teachers in the mathematics area, Mihalko stated that:

> It is essential for teachers to know more than they are expected to teach and to be able to learn more than they already know, for without such knowledge progress is essentially impossible (1978).

Singer and Donlan (1980) stated that through inservice training teachers gained and accommodated new teaching strategies which would help them improve instruction in their schools. For teachers to be more effective in the elementary schools, they should engage themselves in workshops, inservice training programs or some other forms of training so that they will learn more about teaching strategies. In fact, review of literature shows that many rural primary school teachers need to be familiar with different techniques or strategies in teaching mathematics.

Spears (1981) stated that inservice programs should be planned for each semester according to the needs of the teachers. Spears, in his study, concluded that the most desirable time for inservice education would be during the normal school days with release time for teacher participation. The review of literature stressed that inservice training should progress throughout the academic year.

Contemporary Information from the Field of Mathematics Education

The Ministry of Education of Zimbabwe (1983) urged all secondary school graduates who are teaching in elementary schools located in rural areas to go for inservice training programs to update themselves in the areas of mathematics. The NRC (1989) stated that teachers themselves need experience in doing mathematics -- in exploring, guessing,

testing, estimating, arguing and proving -- in order to develop confidence that they can respond constructively to unexpected conjectures that emerge as students follow their own paths in approaching mathematics problems. The report said,

> Too often, mathematics teachers are afraid that someone will ask a question that they cannot answer. Insecurity breeds rigidity, the antithesis of mathematical power (1989, p. 65).

The report emphasized that,

1) Priorities for mathematics education must change to reflect the way computers are used in mathematics.
2) A tradition of elementary school specialists must be created to teach mathematics and science.
3) Prospective teachers should learn mathematics in a manner that encourages active engagement with mathematical ideas.
4) Building national consensus is the first step in renewal of school mathematics.
5) Present educational practice offers mathematics students only a dim light at the end of a very long tunnel.

The Oregon Department of Education (1986) reflected the idea of restructuring the curriculum for the schools in Oregon, placing emphasis on essential learning skills and common knowledge and skills.

Summary

This review of literature dealt with several important areas. "Inservice" itself was defined, as was "rural" education. Emphasis was placed on mathematics inservice training for teachers in K-7 rural schools in Manicaland to improve the quality of instruction. Finally, mathematics education for teachers was reviewed, even though little or no research has been done in this area in rural Manicaland.

The appropriate mathematics education or training of regular classroom teachers to meet the mathematics needs of students is very essential since the society we live in today is becoming a society of high technology and requires the understanding of basic mathematical skills including the most important aspect of mathematics, problem solving. Increased concern to improve the quality of mathematics instruction in our schools has caused many education schools and departments of education to rethink the training of teachers and the creation of extended instructional programs.

CHAPTER III

METHODS AND PROCEDURES

The design of the study, instrument, population and sample, and the procedures used in collecting and analyzing data are included in the presentation and discussion which follows. The descriptive survey method was used in doing this study.

The study was carried out through the following steps:

1) Review of related literature on mathematics in-service education for rural untrained and trained teachers in Manicaland. This was intended to assist the researcher with the conceptual framework for the construction of the data-gathering instruments.
2) Review of mathematics educational documents in Zimbabwe to determine the areas of need as expressed by education officials and by the Ministry of Education in Zimbabwe.
3) Development of instruments, including the pretesting of the questionnaires.
4) Distribution of the questionnaires to the teachers (trained and untrained).
5) Analysis of the data derived.
6) Identification of areas in elementary mathematics of greatest need in the primary schools.

7) Indication of implications of findings for the implementation of inservice training.

The Instrument

The nature of this investigation made the questionnaire an appropriate means of data collection. Two instruments were developed for the teachers, untrained and trained, and one for head teachers. The teachers were asked to respond to 28 items arranged in a Likert-type format. Teachers were asked to respond to the items by marking either minimal, limited, adequate, considerable or very considerable to each item. Responses to each item were assigned points, one through five.

Each questionnaire was constructed in the simplest language which the elementary school teachers would understand. The questionnaires were designed to ascertain information about primary school mathematics teachers' personal and professional backgrounds and also what they might like to see or do during inservice workshops.

Reliability and Validity

In order to estimate the reliability of the questionnaire, 40 randomly selected K-7 school teachers in Manicaland were asked to respond to all items of the questionnaire using a pretest and post test design with a

correlation coefficient was calculated (r = .97). See Table 1 below.

Table 1. Summary of the Results of the Correlation Test for the Reliability of the Questionnaire.

Test	Mean	r
Pretest	3.312	
Post test	3.280	0.97

Validity

The investigator (1989), using experts from the Department of Education as a Delphi panel, concluded that the scale's relevance and content to the issue of mathematics inservice training for K-7 teachers in Manicaland was adequate. Forty K-7 teachers were selected to respond to the questionnaire items, comment about them, and state whether the instrument assessed their need for mathematics inservice training. Results indicated that the instrument was appropriate to measure the need for mathematics inservice training for teachers.

Untrained Teachers' Instrument

Questionnaires took the following forms.

1) Demographic Information: This section included variables of sex, age, marital status, education and years of teaching experience.

2) Perceptions of Needs: These items were designed to cover major competency areas in primary school mathematics such as instructional areas in K-7 school mathematics in which the teachers might need additional training.

3) Open-ended questions: In order to gather more information which will be useful to this study, respondents were asked to feel free in their responses to this section. The headmasters were asked to list the major strengths and weaknesses of the untrained and trained teachers they observe in the schools, and to make recommendations for possible ways of improving the competence of these teachers.

Trained Teachers' Instrument

1) Demographic information.

2) Perceptions of needs.

3) Open-ended questions.

Table 2 on the following page shows the seven variables of the study, along with the part of the questionnaire and the item numbers that corresponded to each variable.

Table 2. Item Construction Table.

Variables	Item numbers
1. Personal and professional information	Part I
2. Mathematics inservice training	Part VI, 29 (open ended)
3. Subject matter knowledge	Part II, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
4. Curriculum	Part IV, 26, 27
5. Classroom/teaching strategies	Part III, 22, 23, 24, 25, 28
6. Instructional materials	Part II, 15, 16, 17, 18, 19, 20, 21
7. Updated information from the field of mathematics education	Part V, 33, 34 (open ended)

Population and Sample

The study was focused on rural schools in Manicaland, Zimbabwe. Subjects for the study included all 120 K-7 rural untrained and trained teachers in 20 schools.

Prior permission to conduct this study in these schools and to involve the designated sample was granted by the Ministry of Education. (See Appendix A for copies of correspondence.)

Collection of Data

Questionnaires and cover letters were mailed to the Ministry of Education through Dr. A. Sana for distribution to the K-7 school teachers. Dr. Sana collected the questionnaires from the teachers and returned them to the researcher. Twenty schools in rural Manicaland were involved in the research.

Data Analysis

Copies of the questionnaires were distributed to the 120 teachers trained and untrained in 20 K-7 schools. These were accompanied by letters of explanation for completing the questionnaire. The following procedure was used in the analysis of data:

1) Frequencies and percentages of responses to each item were tabulated.
2) Scores for both groups were described.
3) The statements were ranked for the untrained and trained groups according to their responses to each of the items.

The Pearson Correlation Coefficient was used to describe the strength of relationship between the responses of the two groups to the 28 needs statements. According to Courtney (1984), the standards listed below give us a qualitative measure of the meaning of coefficients. These

descriptions have been taken from Guilford's text (by permission) and represent an added context in the interpretation of r values.

Level of Reliability

Table 3. Correlation Value Table.

Correlation value	Descriptive meaning
0.00 - 0.49	negative relationship
0.50 - 0.70	moderate correlation - substantial relationship
0.70 - 0.90	high correlation - marked relationship
0.90 - 1.00	very high correlation and dependable relationship

(Courtney, 1984, p. 526)

The above table gives the qualitative description of correlation values which are used to analyze the items in the instrument. If the correlation values are below 0.50, they will be rejected.

The t-test was used to determine if there were significant differences between the means of the two groups and also in the data related to perceptions of need for improvement in the various mathematics competencies.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This chapter presents the results of the data analysis relative to this investigation. The questionnaire was used as a needs assessment instrument to identify the respondents' perceptions of needs for mathematics improvement in the competency areas. These competencies fall under the following rubrics:

1) Mathematics inservice training
2) Subject matter knowledge (content)
3) Curriculum
4) Classroom strategies
5) Instructional materials
6) Updated information from the field of mathematics education.

The competency items found in the questionnaire were derived from the T3, or the diploma of Education for primary school teachers in Zimbabwe.

Results of the survey will be reported in the following order. First the samples of the teachers will be described with respect to relevant background characteristics. Next, the personal information survey will be presented. There will then be a section in which descriptive statistics will be presented, followed by a section in which the relationship between teacher perceptions toward need to improve in the 28 competency

areas are related to teacher background and characteristics, specifically years of experience in teaching.

One of the principal questions of this study concerns the comparison of the perceptions of untrained teachers versus the perceptions of trained teachers regarding the need for improvement in each of the 28 competency areas. The final section of the analysis chapter presents the comparisons of the perceptions of the two groups.

Description of Teacher Sample

One hundred twenty questionnaires were distributed. All questionnaires were returned. Out of 120 teachers who completed the questionnaire, 55% (66) were males and 45% (54) were females. The distribution of teachers by their sex is shown in Appendix B. The frequency distribution of respondents with respect to age is presented in Table 4. The modal category on age was the 20-50+ years old group.

Sixty percent (72) of the respondents were single, 26.7% (32) were married, 6.7% (8) were widowed, 4.1% (5) were separated and 2.5% (3) were divorced. This frequency distribution is presented in Appendix B. All untrained teachers were secondary school graduates who have had 11 to 12 years of schooling. Of the 120 teachers who responded to the questionnaire, 64.2% (77) attended schools in rural areas, 17.5% (21) went to school in urban areas, while the remaining 18.3% (22) of the teachers

Table 4. Frequency Distribution of Age among 120 Responding Teachers.

Age group	N	%
20 or below	15	12.5
21 - 29	35	29.2
30 - 39	40	33.3
40 - 49	21	17.5
50 or over	4	3.3
Uncertain	5	4.2
	120	100.0

indicated that they had attended schools in both rural and urban areas. See Table 5 below.

Table 5. Frequency Distribution of Marital Status among 120 Responding Teachers.

Marital Status	N	%
Single	72	60.0
Married	32	26.7
Widowed	8	6.7
Separated	5	4.1
Divorced	3	2.5
	120	100.0
School Areas Attended		
Rural Schools	77	64.2
Urban Schools	21	17.5
Both Rural and Urban	22	18.3
	120	100.0

Personal Information Survey

There were 120 K-7 school teachers who took part in the study. Table 6 presents personal information of the subjects in the investigation, in terms of certification and years of teaching experience.

Table 6. Summary of the Demographic Information/ Training in the Investigation.

Personal information	Number of teachers	Percent of teachers
SEX		
Male	66	55.0
Female	54	45.0
	120	100.0
EDUCATIONAL QUALIFICATIONS		
T2 Teacher's Certificate	8	6.6
T3 Teacher's Certificate	38	31.7
G.C.E./General Certificate of Education	54	45.0
J.C./Junior Certificate of Education	20	16.7
	120	100.0
TEACHING EXPERIENCE		
0 - 3 years	55	45.9
4 - 6 years	17	14.1
7 - 9 years	19	15.8
10 - 12 years	14	11.7
13 or more years	15	12.5
	120	100.0

The Pearson product moment correlation was employed for an item by item analysis of the instrument. "The bivariate correlation provides a single number which summarizes the relationship between two variables" (Gallagher, 1979). Table 7 shows the correlation response of subjects, which ranged from 0.5-1.00, indicating moderate to very high degrees of relationship. The two means for each item provided by the two groups of teachers, untrained and trained, were correlated to find whether a relationship existed.

Table 7. Correlation of Inservice Training Needs between Trained and Untrained Teachers.

Item number	Item	Correlation	(R)
1.	number operations	high correlation	0.90
2.	probability and statistics	high correlation	0.93
3.	irrational numbers	very high correlation	0.92
4.	rational numbers	very high correlation	1.00
5.	set theory	very high correlation	0.97
6.	geometry	high correlation	0.89
7.	prime numbers	high correlation	0.74
8.	graphing	very high correlation	1.00
9.	trigonometry	high correlation	0.86

Table 7. (continued)

Item number	Item	Correlation	(R)
10.	basic division	high correlation	0.78
11.	basic addition	high correlation	0.81
12.	basic multiplication	high correlation	0.85
13.	basic subtraction	high correlation	0.88
14.	basic computing	very high correlation	1.00
15.	work sheets	very high correlation	1.00
16.	games	very high correlation	1.00
17.	transparencies	very high correlation	1.00
18.	calculators	very high correlation	1.00
19.	computers	very high correlation	1.00
20.	t.v. and radio	high correlation	0.75
21.	tests in the classroom	very high correlation	0.99
22.	teaching method	high correlation	0.80
23.	individual instruction	high correlation	0.87
24.	group work	high correlation	0.76
25.	strategies for teaching slow learners	very high correlation	0.91
26.	problem solving	very high correlation	1.00
27.	curriculum materials	very high correlation	0.95
28.	lesson or unit planning	moderate correlation	0.69

The Six Variables of the Study

The following variables were selected to help the investigator determine the specific needs which the K-7 school teachers in Manicaland, Zimbabwe are requesting:

1) Mathematics inservice training
2) Subject matter knowledge (content)
3) Curriculum
4) Classroom strategies
5) Instructional materials
6) Updated information from the field of mathematics.

Table 8 below shows the answer choice options available to the respondents.

Table 8. Mean Values of Types of Inservice Training.

Qualitative Description mean value	Alternate meaning	Five point option descriptive meaning
1 = 1 - 1.5	not applicable	very considerable
2 = 1.51 - 2.5	no need to improve	considerable
3 = 2.51 - 3.5	some need to improve improve	adequate
4 = 3.51 - 4.5	need to improve	limited
5 = 4.51 - 5	great need to improve	minimal

Descriptive Statistics

Table 9. Variable 1: Mathematics Inservice Training.

Item number	Object statement	Mean
Open ended	Prefer to have workshops or some other types of inservice during weekends, long holidays	4.21

Table 9 above presents the results for the first variable, mathematics inservice training. The results indicate a high mean, and reflect the desire of teachers to have workshops conducted during vacations. The mean for the first variable was 4.21.

On the following page, Table 10 indicates that for the second variable, subject matter knowledge (content), the range of the responses is moderate, with 3.85 as the mean.

The teachers expressed the need to go back to college and learn more mathematics.

Table 10. Variable 2: Subject Matter Knowledge (Content).

Item number	Object statement	Mean
	My knowledge and understanding of:	
1.	basic number operations of decimals and their applications is (1-5)	4.26
2.	basic elementary probability and statistics is (1-5)	4.49
3.	irrational numbers is (1-5)	4.98
4.	rational numbers is (1-5)	4.52
5.	elementary set theory is (1-5)	4.97
6.	elementary geometry is (1-5)	4.36
7.	prime numbers is (1-5)	3.78
8.	graphing is (1-5)	4.57
9.	elementary trigonometry is (1-5)	4.31
10.	basic operations of division is (1-5)	3.41
11.	basic operations of addition is (1-5)	3.48
12.	basic operations of multiplication is (1-5)	3.85
13.	basic operations of subtraction is (1-5)	3.60
14.	computing is (1-5)	4.70

Table 11. Variable 3: Curriculum.

Item number	Object statement	Mean
	My knowledge and understanding of:	
26	unit planning or lesson is (1-5)	3.14
27	curriculum materials such as textbook usage, teacher manuals is (1-5)	4.33

Table 11 indicates that the mean of curriculum understanding is moderate, and teachers expressed the need to learn more about managing the curriculum. As indicated, the mean is between 3.14 and 4.33.

Table 12 below, concerning variable 4, reveals a high mean reflecting the desire for teachers to improve their classroom strategies. This mean lies between 4.90 and 3.65.

Table 13, also below, shows a high mean response, indicating that the teachers need or are very much interested in workshops that will help them improve their usage of teaching aids in classrooms. The mean range was 3.04 to 4.94.

Table 12. Variable 4: Classroom or Teaching Strategies.

Item number	Object statement	Mean
	My knowledge and understanding of:	
22	teaching methods is (1-5)	3.95
23	individual instruction is (1-5)	4.19
24	group work is (1-5)	3.65
25	strategies for teaching slow learners is (1-5)	4.32
28	problem solving is (1-5)	4.90

Table 13. Variable 5: Instructional Materials.

Item number	Object statement	Mean
	My knowledge and understanding of applying teaching aids needs improvement in:	
15	worksheets (1-5)	4.92
16	games (1-5)	4.39
17	transparencies (1-5)	4.89
18	calculators (1-5)	4.66
19	computers (1-5)	4.94
20	t.v. and radio (1-5)	3.04
21	tests in the classroom (1-5)	4.78

Table 14. Variable 6: Updated Information in the Field of Mathematics.

Item number	Object statement	Mean
Open ended	Need to know more in mathematics	4.85

Table 14 above indicates that a majority of the teachers believe that they need to know more about mathematics in this world of advanced science and technology. The mean score was for the seven items was 4.85.

Statistics

The teachers expressed the need to have inservice training in all six variables discussed. Mean scores clearly reflected the need for training in all areas of mathematics education in the primary schools. High mean scores were found in the area of teaching aids such as calculators, computers and math games. Teachers expressed the need for inservice training during long vacations and also during certain weekends. Both groups of responses to the competency items were consistent and expressed great need to improve in the areas of math education.

There was no significant difference between the means of the two groups' perception of need for improvement in the competency items. Statistical analysis revealed that tabular value t = 2.101 at the .05 level did exceed the computed valule of t = 1.66, indicating a retention of the hypothesis.

Teachers' Responses to Twenty-eight Items

Teachers trained and untrained were asked to indicate their perception of need to improve in twenty-eight competency items. These competencies are divided into four major rubrics: 1) subject matter (content), 2) teaching aids, 3) teaching strategies and 4) curriculum.

Table 15 presents the responses of the teachers to each of the twenty-eight competency items. The table presents the number and percentage of teachers who indicated a "definite need," "some need," or "no need" to improve in each of the competency items.

A majority of the teachers indicated a definite need to improve in the area of teaching aids (computers, calculators, and classroom tests). Problem solving was another area where improvement was greatly needed. In general, teachers needed improvement in all areas, which included subject matter knowledge, curriculum, teaching strategies, instructional materials, time for workshops and updated information from the field of mathematics education.

Table 15. Teachers' Responses to Twenty-eight Competency Items (total number responding = 120).

Items	Teachers					
	Definite need to improve		Some need to improve		No need to improve	
	N	%	N	%	N	%
SUBJECT MATTER (CONTENT)						
1. basic number operations of decimals and their application	51	42.5	62	51.7	7	5.8
2. basic elementary probability and statistics	96	80.0	19	15.8	5	4.2
3. irrational numbers	61	50.8	56	46.7	3	2.5
4. rational numbers	53	44.2	64	53.3	3	2.5
5. elementary set theory	55	45.8	59	49.2	6	5.0
6. elementary geometry	72	60.0	37	30.8	11	9.2
7. prime numbers	81	67.5	32	26.7	7	5.8
8. graphing	48	40.0	65	54.2	7	5.8
9. elementary trigonometry	71	59.1	38	31.7	11	9.2
10. basic division	59	49.2	47	39.2	14	11.6
11. basic addition	58	48.3	50	41.7	12	10.0
12. basic multiplication	50	41.7	53	44.2	17	14.1

Table 15. (continued)

Items	Teachers: Definite need to improve N	%	Some need to improve N	%	No need to improve N	%
13. basic subtraction	44	36.7	61	50.8	15	12.5
14. basic computing	111	92.5	4	3.3	5	4.2
TEACHING AIDS						
15. work sheets	61	50.8	56	46.7	3	2.5
16. games	83	69.2	36	30.0	1	0.8
17. transparencies	113	94.1	5	4.2	2	1.7
18. calculators	116	96.7	4	3.3	0	0.0
19. computers	119	99.2	1	0.8	0	0.0
20. t.v. and radio	55	45.8	63	52.5	2	1.7
21. tests in the classroom	102	85.0	18	15.0	0	0.0
TEACHING STRATEGIES						
22. teaching method	70	58.4	43	35.8	7	5.8
23. individual instruction	61	50.8	55	45.8	4	3.3

Table 15. (continued)

Items	Teachers: Definite need to improve N	Definite need to improve %	Some need to improve N	Some need to improve %	No need to improve N	No need to improve %
24. group work	52	43.3	65	54.2	3	2.5
25. strategies for teaching slow learners	77	64.2	43	35.8	0	0.0
26. problem solving	104	86.6	8	6.7	8	6.7
CURRICULUM						
27. curriculum materials such as textbook usage, teacher manuals	71	59.2	39	32.5	10	8.3
28. lesson or unit planning	48	40.0	41	34.2	31	25.8

Untrained Teachers' Responses to Twenty-eight Competency Items

Table 16 below shows the responses of untrained teachers. Teachers indicated a definite need to improve in almost all items. A large percentage of the untrained teachers needed improvement in all of the competency items.

Table 16. Untrained Teachers' Responses to Twenty-eight Competency Items (N = 54).

Items	Teachers					
	Definite need to improve		Some need to improve		No need to improve	
	N	%	N	%	N	%
1. number operations	31	57.4	22	40.7	1	1.9
2. probability and statistics	47	87.0	7	13.0	0	0.0
3. irrational numbers	46	85.2	8	14.8	0	0.0
4. rational numbers	50	92.6	4	7.4	0	0.0
5. set theory	52	96.3	2	3.7	0	0.0
6. geometry	51	94.4	2	3.7	1	1.9
7. prime numbers	43	79.6	9	16.7	2	3.7
8. graphing	45	83.3	6	11.1	3	5.6
9. trigonometry	41	75.9	9	16.7	4	7.4
10. basic division	44	81.5	6	11.1	4	7.4
11. basic addition	42	77.8	10	18.5	2	3.7
12. basic multiplication	40	74.1	12	22.2	8	3.7
13. basic subtraction	43	79.6	7	13.0	4	7.4
14. basic computing	48	88.9	5	9.2	1	1.9
15. work sheets	50	92.6	4	7.4	0	0.0
16. games	53	98.1	1	1.9	0	0.0
17. transparencies	54	100.0	0	0.0	0	0.0
18. calculators	54	100.0	0	0.0	0	0.0
19. computers	54	100.0	0	0.0	0	0.0

Table 16. (continued)

Items	Teachers: Definite need to improve N	%	Some need to improve N	%	No need to improve N	%
20. t.v. and radio	49	90.7	3	5.6	2	3.7
21. classroom tests	54	100.0	0	0.0	0	0.0
22. teaching method	44	81.5	10	18.5	0	0.0
23. individual instruction	47	87.0	4	7.4	3	5.6
24. group work	52	96.3	1	1.9	1	1.9
25. slow learner strategies	53	98.1	1	1.9	0	0.0
26. problem solving	48	89.9	6	11.1	0	0.0
27. curriculum materials	46	85.2	5	9.2	3	5.6
28. lesson or unit planning	30	55.6	16	29.6	8	14.8

Trained Teachers' Responses to Twenty-eight Competency Items

Table 17 below presents the responses of trained teachers. Trained teachers expressed a need to improve in the teaching aids competencies. This is indicated by the fact that 100% of them saw a definite need in using computers and 97% saw a definite need to improve in the use of calculators. The trained teachers generally perceived a need to improve in all the competencies.

Table 17. Trained Teachers' Responses to Twenty-eight Competency Items (N = 66).

Items	Teachers					
	Definite need to improve		Some need to improve		No need to improve	
	N	%	N	%	N	%
1. number operations	29	44.0	22	33.3	15	22.7
2. probability and statistics	48	72.7	13	19.7	5	7.6
3. irrational numbers	44	66.7	19	28.8	3	4.5
4. rational numbers	46	69.7	17	25.8	3	4.5
5. set theory	53	80.3	7	10.6	6	9.1
6. geometry	42	63.6	14	21.2	10	15.2
7. prime numbers	45	68.2	16	24.2	5	7.6
8. graphing	51	77.3	11	16.7	4	6.0
9. trigonometry	50	75.8	9	13.6	7	10.6
10. basic division	41	62.1	15	22.7	10	15.2
11. basic addition	39	59.0	17	25.8	10	15.2
12. basic multiplication	43	65.2	14	21.2	9	13.6
13. basic subtraction	38	57.5	17	25.8	11	16.7
14. basic computing	53	80.3	9	13.6	4	6.1
15. work sheets	49	74.3	14	21.2	3	4.5
16. games	55	83.3	10	15.2	1	1.5
17. transparencies	57	86.4	7	10.6	2	3.0
18. calculators	64	97.0	2	3.0	0	0.0
19. computers	66	100.0	0	0.0	0	0.0
20. t.v. and radio	59	89.4	7	10.6	0	0.0

Table 17. (continued)

Items	Teachers: Definite need to improve N	%	Some need to improve N	%	No need to improve N	%
21. classroom tests	65	98.5	1	1.5	0	0.0
22. teaching method	40	60.6	19	28.8	7	10.6
23. individual instruction	58	87.9	7	10.6	1	1.5
24. group work	52	78.8	12	18.2	2	3.0
25. slow learner strategies	57	86.4	9	13.6	0	0.0
26. problem solving	44	66.7	14	21.2	8	12.1
27. curriculum materials	46	69.7	15	22.7	7	10.6
28. lesson or unit planning	40	60.6	3	4.5	23	34.8

Comparison of Teachers' Responses to the Twenty-eight Items in the Instrument

There was an identified need to improve in the area of teaching aids, teaching strategies and problem solving. The two groups of teachers did not show marked difference in their responses to the items. Teachers were very consistent in responding to the items. Experienced teachers were more likely to see a definite need to improve in mathematics content, mathematics curriculum and

instructional materials. Less experienced or untrained teachers were more likely to see a definite need to improve in all the items in the instrument.

Responses of Headmasters to Open-ended Questions

In addition to structured items, open-ended unstructured questions were included in the survey instrument. The headmasters were asked to comment on some other needs they might have which were not mentioned in the list of 28 items in part five. Respondents were asked to feel free to include anything of a relative nature in their responses to this section. The headmasters were asked to comment and list the major weaknesses and strengths of the teachers in their schools. The headmasters were also asked to make recommendations for possible ways of improving mathematics teaching in these schools. This part of the questionnaire was completed rather hurriedly by the headmasters. Headmasters did not concentrate on strengths or weaknesses but rather on recommendations. The immediate impression was that the headmasters were not ready to evaluate their teachers for reasons which were not immediately apparent.

The respondents indicated that the teachers needed to improve their skills in presenting mathematics problems to the children in the classroom and to let children feel free to say what they want when it comes to mathematics

problem solving. The headmasters believed that the teachers were hard working and were willing to improve their teaching by attending mathematics workshops.

Headmasters' Recommendations

The headmasters made the following recommendations:

a) Math courses should be taken in teacher training colleges.

b) Math workshops for teachers must be created.

c) Specialists in math must work together with school teachers.

d) Math demonstration lessons by math teacher educators should be given.

Headmasters emphasized the need for teachers to improve their skills in teaching mathematics, especially in those skills which deal with the mathematics curriculum.

Table 18. Additional Needs of Teachers.

Needs	N*	%
1. Math books	51	42.5
2. Math games	43	35.8
3. Teacher guides	11	9.2
4. Motivation from superiors	9	7.5
5. Teacher/headmaster relationship	6	5.8
	120	100.0

Table 19. Weaknesses of Untrained Teachers as Perceived by Responding Headmasters.

Weakness	N	%
1. Math knowledge	7	46.7
2. Teaching strategies	2	13.3
3. Lesson planning	2	13.3
4. Problem solving	4	27.7
	15	100.0

Table 20. Headmasters' Recommendations.

Recommendation	N	%
1. Math courses in training colleges	3	20.0
2. Math workshops	3	20.0
3. Specialists in math are wanted	2	13.3
4. Math demonstration lessons are vital	7	46.7
	15	100.0

Summary

In this study, the focus was on the inservice mathematics education of rural K-7 primary school teachers in Manicaland, Zimbabwe. The teachers, trained and untrained, indicated a great need to have mathematics inservice workshops during the holidays. The headteachers agreed that inservice workshops would help the teachers to better teach mathematics in their schools.

Descriptive statistics and Pearson Product Moment Correlation were applied during the analysis of the data. The t-test was used to determine if there was a significant difference between the means of the two responding groups of teachers, trained and untrained. The average mean on descriptive statistics, which falls between 4.00 and 4.50, was computed, indicating a very high need to improve in the teaching competency areas.

The headteachers recommended that more math courses should be taught in teacher training colleges, and math demonstration lessons should be conducted by experts in the field of mathematics education and teaching.

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

This chapter consists of four sections. First, the summary is presented, including the purpose of the study and a review of research procedures and findings. Second, conclusions are formulated and presented on the basis of the findings. Third, a discussion of the findings is presented; recommendations are then made based on the conclusions.

Summary and Findings

This study was initiated by an urgent need to revitalize mathematics education in the schools in Zimbabwe. Information gathered on this topic indicates that studies on mathematics training for teachers are going on and are very crucial to the survival of any nation. The purpose of the study was to determine the need for mathematics inservice training for untrained and trained teachers in K-7 schools in Manicaland, Zimbabwe.

The data produced from the study pointed out that both untrained and trained teachers in K-7 schools in Manicaland expressed the need for training in mathematics.

Teachers (untrained and trained) from twenty schools in Manicaland made up the sample group for the investigation. The sample consisted of 120 teachers.

A 28-item questionnaire was used in the investigation. The instrument analyzed the areas in elementary mathematics which would help the K-7 teachers during classroom instruction.

Descriptive statistics and the Pearson Product Moment were applied during the analysis of the data. The reliability of the items in the instrument ranged from 0.50 (moderate relationship) to 1.00 (very dependable relationship), making the instrument very valid.

There were no significant differences between the trained and untrained teachers with respect to the need for mathematics inservice education.

Primary school teachers indicated that workshops were very important if they were to keep abreast of what was taking place in the field of mathematics education. Teachers who participated in the study also provided information about what should or can be done during the workshops.

All 120 K-7 school teachers indicated the need for mathematics inservice training ranging from very considerable (not applicable) to minimal (great need to improve). The subjects in the sample group indicated a very high need for training in areas of problem solving, math knowledge and teaching aids.

Conclusions

On the basis of the data collected from the 120 teachers surveyed, the following conclusions were made:

1. There were no significant differences between the mean scores of the two groups of teachers on mathematics knowledge and teaching aids.

2. Practicing teachers have a strong interest in the improvement of mathematics teaching in K-7 schools in rural Manicaland. This is clearly indicated on teachers' responses to the items.

3. Untrained or temporary teachers have a strong desire to go to teachers colleges and take mathematics courses.

4. There were no significant differences between the trained and untrained teachers with respect to the need for mathematics inservice education. The teachers indicated that workshops were necessary during the weekends and long holidays.

5. Mathematics inservice programs and workshops should be conducted by experts from the fields of education and mathematics. The headmasters supported this idea.

Discussion

In Chapter IV, the statistical treatment of the data derived from the survey instrument was reported. This section presents the discussion of the findings of the study. A 28-item questionnaire was employed to measure the mathematics inservice needs of 120 teachers. These items constituted a central part of the needs assessment questionnaire used to identify the competency needs of teachers (trained and untrained) in K-7 rural schools in Manicaland, Zimbabwe.

Significant findings from the analysis are discussed below: demographics, areas of need, marked and nonmarked relationships identified through crosstabulations of responses to each of the twenty-eight competency items.

The information from the demographics gave a sense of the culture and the history which patterned the system of education in Zimbabwe. The educational scene has been male dominated. The data on sex of respondents from the questionnaire validated the same state of affairs. The situation, however, is gradually changing. Women are now entering the teaching profession, and parents are now investing in their daughters as profitable human resource development. The data on age showed that a good number of the teachers were fairly young. The data indicated that the average teacher has been in the classroom for 6-9

years. The quality of the teachers in Zimbabwe grade schools has remained a subject of great concern.

With respect to the headmasters, the data analysis revealed that there were more males than females, all middle aged. None of the headmasters had a bachelor's degree. All of them had the equivalent of a T_3 teacher's certificate and had been teaching for an average of fifteen years. Most of the untrained teachers fell into the 19-29 year old group. In spite of their young age, the average auxiliary teacher has had 4-9 years of experience as a classroom teacher. Another positive note is that headmasters need to upgrade their mathematics knowledge because they have been long in the system without any further training and professional development. There have been many changes in the mathematics curriculum, and new technologies have been designed to facilitate instruction.

There was a definite need to improve in nearly all items in the questionnaire except on item number 28, lesson or unit planning, where the teachers felt comfortable. The two groups of teachers did not show marked difference in their responses to the items.

The teachers agreed that mathematics inservice workshops were necessary to help them improve in the instruction of elementary mathemtics in their classrooms.

In some areas, such as teaching methods and strategies for teaching slow learners, the correlation between the two revealed some differences. This could be partly because of the rigid and unchanging educational scene in rural schools today. The teaching methods that were applicable 10 years ago are still in use today.

Fourteen items in the questionnaire had a very high correlation. Thirteen items had a high correlation. One item had a moderate correlation. These responses indicate that there was a general agreement among the teachers about the need to improve in the instruction of mathematics and also about the need to have workshops. There was a high degree of agreement in the following areas: the need for computers, calculators, transparencies, and work sheet games. There was a general agreement in content improvement among the teachers.

Table 21 on the following page presents a summary of some of the results that have been discussed in this section. The table reflects some areas in which teachers agreed strongly and some areas in which they didn't need much help. They all agreed that computers and calculators were very necessary if mathematics education was to improve in the schools.

Table 21. Summary of Some of the Discussed Results.

No.	Item	R	Mean	Teachers who Responded Need to Improve		
				Total	Untrained	Trained
1.	Number operations	0.90	4.26	113	53	60
6.	Geometry	0.89	4.36	109	50	56
9.	Trigonometry	0.86	4.31	109	50	59
14.	Computing	1.00	4.70	115	53	62
18.	Calculators	1.00	4.66	120	54	66
19.	Computers	1.00	4.94	120	54	66
22.	Teaching method	0.80	3.95	113	54	59
26.	Problem solving	1.00	4.90	112	54	58
28.	Lesson or unit planning	0.69	3.14	89	46	43

Recommendations for Further Research

This study was descriptive. Many issues emerged from it which point to the need for further research. The following recommendations are suggested for further investigation.

1. A study similar to the present study should be made to determine whether or not the content of elementary mathematics inservice training was implemented in the classrooms.

2. There is need for the Ministry of Education to address the issue of retraining teachers in the nation's schools.

3. Problem solving, as a skill, must be emphasized both for preservice and inservice teachers.

4. A study should be conducted to determine additional teacher needs by involving people such as teacher educators and officials of the Ministry of Education.

5. A study should be done to determine whether there is a significant relationship between K-7 teachers of mathematics and teachers of mathematics in grades 8-12 in schools of Zimbabwe.

6. There is need for research with emphasis on mathematics competencies peculiar to teaching in the rural setting.

Inservice Mathematics Education Program

Most citizens and too many teachers view mathematics as the production of correct answers. Teachers put too much emphasis on arithmetic computation and drill. They give little attention to problem solving and estimation.

Many mathematics programs focus too much on the development of routine computational skills and too little on understanding mathematical concepts. The mathematics used in the world today is not the same as that used or needed a century ago.

A number of studies reveal critical weaknesses in the way teachers teach mathematics. Many of these problems are the result of teachers' misunderstanding of basic mathematical concepts and their misconceptions about which skills deserve to be emphasized.

Here are some of the problems encountered by teachers in K-7 schools during math lessons.

a) Lack of development: Mathematics instruction in the K-7 schools is textbook-driven and emphasizes drill. Fifty percent of class time must be spent on development concepts.

b) Lack of quality in development: Most development lessons focus on memorization rather than on understanding and visualizing concepts or on making generalizations.

c) Procedures: Not much emphasis is given to problem solving.

The program I will design will emphasize or will give attention to

1) mathematics content,
2) methods of teaching mathematics,
3) classroom management,
4) planning, which includes curriculum planning and interpreting the syllabus,
5) classroom operation, and
6) innovation.

The key topics to be discussed in the inservice training will include

1) problem solving,
2) estimation,
3) mental computation,
4) computers, and
5) teaching effectiveness, which will be the main goal and will also help teachers understand what development is all about.

The untrained teachers need special attention: many of them need programs that emphasize remedial mathematics because their educational background lacks a lot of mathematics understanding. The main objective will be to make these untrained teachers become good teachers in terms of mathematics teaching.

BIBLIOGRAPHY

Abshire, M.J. A Study of the Preservice Education, Inservice Education and Problems and Needs Identified by Elementary School Teachers of Mathematics. Unpublished Doctoral Dissertation, McNeese State University, 1973.

Aichele, B.D. Mathematics Teacher Education: Critical Issues and Trends (1978).

Alpen, M. The Subject Curriculum: Grades K-12. Temple University, 1967.

Archer, P. Clifford. Elementary Education in Rural Areas. New York, 1955.

Ashlock, R. and W.L. Herman, Jr. Elementary School Mathematics. London: The Macmillan Collier-Macmillan Limited, 1970.

Atkinson, N. (ed). Papers for in-service courses, mimeo. University of Zimbabwe Education Faculty, Salisbury (1980).

Bottoms, Gene. "Responsibilities for Inservice Education" in Rethinking Inservice Education. Edited by Roy A. Edelfelt and Margo Johnson (Atlanta: National Education Association, 1975) p. 39.

Bruner, J.S. Toward a Theory of Instruction. Cambridge: Harvard University Press, 1964.

Chase, Francis S. and Baker, E. John. Education in Rural Communities. The 51st Yearbook of the National Society for the Study of Education, Part II. Edited by Henry B. Nelson. Illinois: University of Chicago Press, 1952.

Cohen, J. Statistical Power Analysis for the Behavioral Sciences. New York: Academic Press, 1969.

Commonwealth Secretariat. Teacher Education in a Changing Society. Commonwealth Conference on Teacher Education held in Nairobi, Kenya. London: Commonwealth Secretariat, 1974.

Corvallis Gazette-Times: Teachers must master their academic subjects. March 11, 1989.

Courtney, E.W. Analysis. Corvallis: Oregon State University, 1984.

Drenes, Z.P. An Experimental Study of Mathematics Learning. London: Hutchison Co., Ltd., 1963.

Dirocco, P. Preparing for the Mainstreaming Environment: A Necessary Addition to Preservice Curricula. Journal of Physical Education and Recreation, 48, (1978) 24-25.

Dossey, John A. The Current Status of Preservice Elementary Teacher Education Programs. Arithmetic Teacher 19, (1981), 24-26.

Dutton, W.H. University Students' Comprehension of Arithmetic Concepts. The Arithmetic Teacher, February, 1961.

Edington, Everett D. and Conley, K. Howard. Education in Isolated Rural Areas. New Mexico: ERIC Clearinghouse for Rural Education and Small Schools, ED 077 626, 1973.

El Shibiny, M. Trends in the Ruralization of Primary School Curriculum in the Seventies and the Role of Teacher Education Institutions in Asia. Paris: UNESCO, ED 075 118, 1970.

Fafunwa, Babs A. New Perspectives in African Education. London: MacMillan Education Limited, 1967.

Fattu, Nicholas A. Nine Proposals for Elementary Teacher Education: A Description of Plans to Design Exemplary Training Programs. Washington, D.C.: Office of Education (DHEW), 1968.

Flener, Frederic. Mathematics Teaching in the Primary Schools in England: An American Perspective. School Science and Mathematics, 1984(84), 91-99.

Foght, W. Harold. The rural teacher and his work: In community leadership, in school administration and in mastery of the school subjects. (1918).

Foster, Philip and Sheffield, R. James (eds.). Education and Rural Development, The World Yearbook of Education 1974. London: Evans Brothers Limited, 1974.

Gallagher, Patricia R. The Context in Which Student Teaching Occurs and its Effect on Student Teacher performance. Unpublished research, 1979.

Harris, B.M. Improving Staff Performance through Inservice Education. Allyn and Bacon Inc., 1970.

Harris, B.M. and Bessent, Wailand. In-Service Education: A Guide to Better Practice. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1969.

Houston, W.R. Improving Mathematics Education for Elementary School Teachers. Michigan State University, 1967.

Kanengiser, Andy. Are Too Many Teachers out of their Element? U.S.A. Today, September 4, 1985.

Kramer, K. Problems in the Teaching of Elementary School Mathematics. Allyn & Bacon, 1970.

Krause, F. Eugene. Mathematics for Elementary Teachers. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978.

Krulik, S. and Jesse A. Rudnik. Problem Solving: A Handbook for Elementary School Teachers. Allyn and Bacon, Inc., 1988.

Lerch, H.H. Blocks to Successful Mathematics Programs or How to Ensure Failure by Really Trying. Arithmetic Teacher in Elementary School. Washington, D.C., 1970.

Luke, A. Robert. Teacher Centered In-Service Education Planning and Products. Washington, D.C.: National Education Association. 1980.

Maybury, R.H. Technical Assistance and Innovation in Science Education. New York, 1975.

Mihalko, John C. "The Answer to the Prophets of Doom: Mathematics Teacher Education." Mathematics Teacher Education: Critical Issues and Trends. Washington, D.C., National Education Association of the U.S.A., 1978.

Ministry of Education. National Education Scheme. Harare, 1983.

Moffit, C. John. In-Service Education for Teachers. Washington, D.C., 1963.

Murphree, M.M. (Ed.). Education, Race, and Development in Rhodesia. University of Zimbabwe Centre for Applied Social Science, Harare, 1975.

National Council of Teachers of Mathematics. An Agenda for Action: Recommendations for School Mathematics of the 1980s. April, 1980.

National Research Council. Everybody Counts: A Report to the Nation on the Future of Mathematics Education. Washington, D.C., 1989.

Oberholtzer, E.E. Awareness of the Problem of Rural Education on the Report of Urban Education, Vol. 72. Washington, D.C.: National Education Association, 1939.

Oregon Department of Education. Mathematics Curriculum Goals. 1989.

Orrange, P.A. and M.V. Rye. Agency Roles and Responsibilities in Inservice Education. Rethinking Inservice Education. Washington, D.C.: National Education Association, 1975.

Pankratz, Roger. "Teacher Education Today: A Case for the Rural Minority." Journal of Teacher Education, 26:2 (1975), 107-108.

Portland Oregonian. The state of mathematics and science in U.S. schools. May, 1989.

Recommendations for the Training of Teachers of Mathematics. Mathematics Association of America, 1961.

Riedesel, C. Alan and Leroy G. Callahan. Elementary School Mathematics for Teachers. New York: Harper and Row, 1977.

Rubin, Louis (ed.). The In-Service Education of Teachers. Boston: Allyn and Bacon, Inc., 1978.

Ruddel, A.K., Dutton, W., and J. Reckzek. Background Mathematics for Elementary Teachers, Instruction in Arithmetic. Twenty-fifth Yearbook of the National Council of Teachers of Mathematics. Washington, D.C.: The Council, Ch XIII, 1960.

Siedow, Mary Dunn, Memory, David M., and Bristow Pages. Inservice Education for Content Area Teachers. Newark, Delaware: International Reading Association, 1971.

Singer, H. and D. Donlan. Reading and Learning from Text. Little Brown and Co., 1980, p. 511.

Sparks, J.N. Arithmetic Understandings Needed by Elementary School Teachers. The Arithmetic Teacher, December, 1961, pp. 395-403.

Spears, P.W. Effective Elements of Inservice Programs as Perceived by Indiana Public School Teachers. Dissertation Abstracts, 1982, p. 43.

Steen, A. Lynn and Donald J. Albers. Teaching Teachers, Teaching Students: Reflections on Mathematical Education. Boston: Birhauser, 1981.

Stronck, D.R. The Attitudes and Needs of Inservice Science Teachers. Science Education 1974 58(4), 505-508.

Surapunt, C. Problems and Needs in Preservice Elementary School Mathematics Programs in Thailand. Dissertation Abstracts International 44: 342A, 1980.

Swetz, Frank. Mathematics Education in China, Its Growth and Development. MIT Press, 1974.

Tamblyn, Sevis R. Rural Education in the United States. Washington, D.C.: Department of Rural Education, NEA, ED 043 408, 1960.

Tazi, A.H. Education in the Arab States in the Light of the Abu Dhabi Conference. UNESCO Educational Studies and Documents No. 36, 1980.

Trevaskis, Graham. In-Service Teacher Training in English Speaking Africa. New York: Afro-Anglo-American Programme in Teacher Education, 1969.

Turner, John. "Teacher Education in Predominantly Rural Countries." British Journal of Teacher Education, 4:3 (1978) 175-186.

United Nations Educational, Scientific and Cultural Organization. Education in Rural Environment. Paris: UNESCO, 1974.

Woolfolk, A.E. and M. Nicolich. Educational Psychology for Teachers. New Jersey, 1980.

Zimbabwe, Republic of. At Five Years of Independence Achievements, Problems and Prospects. 1985.

APPENDICES

APPENDIX A

Letter of Request to Conduct a Study in Selected K-7 Schools in Manicaland.

Letter of Permission to Conduct a Study in Selected K-7 Schools in Manicaland.

The Survey Instruments and Accompanying Letter to the Respondents.

School of Education
OSU/WOSC

A merged School serving Oregon State University and Western Oregon State College with graduate and undergraduate programs in Education.

OFFICE OF DOCTORAL STUDIES

January 10, 1989

The Secretary of Primary and
Secondary Education
P.O. Box 8022
Causeway, Harare

Re: Request for Permission to Conduct a Study in Primary Schools in Manicaland

I have the honor to request of your good offices the involvement of teachers in some schools in the Manicaland area in a study which I am conducting.

This exercise is part of the requirements for the degree of Doctor of Philosophy in Education in the Department of Educational Foundations and Psychology, and Administration and Teaching at Oregon State University, Corvallis.

The enclosed copy of my dissertation proposal and abstract will give you some hints as to the nature of the study.

Thank you in advance for your cooperation.

Sincerely yours,

Redacted for Privacy

Tendekai Don Makande

TM:hm

Encl.

Department of Foundations and Educational Specialties
[illegible] Education Hall, Room 423 Corvallis, Oregon 97331 (503) 754-3648

Telephone: 734050/734060/734071
Telegraphic address: "EDUCATION"

All communications should be addressed to
"The Secretary for Primary and
Secondary Education"

ZIMBABWE

Reference: C/426/3

MINISTRY OF PRIMARY AND
SECONDARY EDUCATION
P.O. BOX 8022
CAUSEWAY

10 May 1989

Tendekai Don Makande
130 NW 14th, 10
Corvallis, OR 97330
OREGON
U.S.A.

RESEARCH PERMIT

You are hereby granted permission to carry out research in Educational Foundation: Teaching, Administration, Supervision and Psychology with special emphasis on the need for mathematics in-service education for teachers.

As your research involves schools in Manicaland Region, please liaise with the Regional Director of Manicaland region for clearance to involve some of his teachers in your research.

It would be appreciated if this Ministry could be favoured with a copy of your findings.

Redacted for Privacy

R. Sisimayi
for: SECRETARY FOR PRIMARY AND SECONDARY EDUCATION

B/SM

School of Education
OSU WOSC

A merged School serving Oregon State University and Western Oregon State College with graduate and undergraduate programs in Education.

OFFICE OF DOCTORAL STUDIES

May 25, 1989

Dear Colleague,

You are asked to render help in an educational research study. Enclosed is a questionnaire designed to determine the future needs for mathematics in-service training in our K-7 schools of Zimbabwe. You are asked to complete the questions attached.

The future curriculum planning and development in grade schools depends on the information you will provide. Your assistance and cooperation will be greatly appreciated. Thank you.

Yours sincerely,

Redacted for Privacy

Tendekai Makande
c/o Mr. Able Sana

TM:ma

Department of Foundations and Educational Specialties
OSU Campus: Education Hall, Room 423 · Corvallis, Oregon 97331 · (503) 754-3648

PART I

PERSONAL AND PROFESSIONAL INFORMATION

This part of the questionnaire is designed to ascertain information about your personal and professional background as an elementary school teacher in the rural schools of Manicaland, Zimbabwe. Please respond to the following items by putting a check ( ) where appropriate and writing out where necessary.

1. Sex _____ Male _____ Female

2. Age:
   - _____ 20 and below
   - _____ 21 to 29
   - _____ 30 to 39
   - _____ 40 to 49
   - _____ 50 and over
   - _____ not sure

3. Marital status:
   - _____ Single
   - _____ Married
   - _____ Separated
   - _____ Widowed
   - _____ Divorced

4. Educational background (specify highest education attained):
   - _____ Primary
   - _____ Secondary
   - _____ T2
   - _____ T3
   - _____ Other (please specify)

5. I have been teaching for

_____ less than 1 year
_____ 1 to 2 years
_____ 3 to 4 years
_____ 5 to 6 years
_____ 7 to 8 years
_____ 9 years or more

6. The number of children in my class is

_____ 10 to 25 pupils
_____ 26 to 50 pupils
_____ 51 to 75 pupils
_____ 76 pupils or more

7. I have been teaching (check as many as are applicable)

grade 1 for _____ years
grade 2 for _____ years
grade 3 for _____ years
grade 4 for _____ years
grade 5 for _____ years
grade 6 for _____ years
grade 7 for _____ years

8. My school has

_____ less than 100 pupils
_____ 101 to 200 pupils
_____ 201 to 300 pupils
_____ 301 to 400 pupils
_____ 401 or more pupils

9. My school has

_____ less than 10 teachers

_____ 11 to 20 teachers

_____ 21 to 30 teachers

_____ 31 to 40 teachers

_____ 41 to 60 teachers

_____ 61 or more teachers

10. How many headmasters are at your school?

_____

11. Name of your present school

_____

12. Address of your school

_____

_____

_____

PART II

The intent of this portion of the questionnaire is to determine the instructional areas in K-7 school mathematics in which you may need training. Please answer each question by circling the number representing the appropriate response, where you give:

minimal	=	5
limited	=	4
adequate	=	3
considerable	=	2
very considerable	=	1

Given that workshops and other types of inservice are an appropriate means of extending teacher knowledge and understanding in the field of mathematics and in order to do the best possible job of teaching my students, my knowledge and understanding of:

1.	basic number operations of decimals and their application is	5	4	3	2	1
2.	basic elementary probability and statistics is	5	4	3	2	1
3.	irrational numbers is	5	4	3	2	1
4.	rational numbers is	5	4	3	2	1
5.	elementary set theory is	5	4	3	2	1
6.	elementary geometry is	5	4	3	2	1
7.	prime numbers is	5	4	3	2	1

8.	graphing is	5	4	3	2	1
9.	elementary trigonometry is	5	4	3	2	1
10.	basic operations of division is	5	4	3	2	1
11.	basic operations of addition is	5	4	3	2	1
12.	basic operations of multiplication is	5	4	3	2	1
13.	basic operations of subtraction is	5	4	3	2	1
14.	computing is	5	4	3	2	1

PART III

In this part of the questionnaire please answer each question by circling the number representing the appropriate responses, where you give:

extensively	=	5
moderately	=	4
little	=	3
very little	=	2
not at all	=	1

My knowledge and understanding of developing and applying teaching aids to my students need improvement in:

1.	worksheets	5	4	3	2	1
2.	games	5	4	3	2	1
3.	transparencies	5	4	3	2	1

PART V

1. I would prefer to have workshops or some other types of inservice during

   _____ weekends

   _____ long holidays

   _____ during the school term

   _____ other (specify)

2. I would prefer to have workshops or some other type of inservice which helps me in the following areas: (list them, please)

   _____

   _____

   _____

   _____

3. If you have other concerns about mathematics inservice education for primary school teachers, please state them here:

   _____

   _____

   _____

   _____

Headmasters (only)

OPEN ENDED ITEMS

Directions: Please respond to the following questions as sincerely as you can. Your answers should reflect the need to improve mathematics teaching. This is very important to the investigators.

1. What are the major strengths exhibited by auxiliary teachers? Please list them.

_____

_____

_____

_____

2. What are the auxiliary teachers' major weaknesses?

_____

_____

_____

3. What are your recommendations for improving the competence of auxiliary teachers?

_____

_____

_____

APPENDIX B

SUPPLEMENTARY TABLES

Table 22. Distribution of Untrained Teachers by Sex.

Table 23. Distribution of Untrained Teachers According to Marital Status.

Table 24. Distribution of Trained Teachers by Sex.

Table 25. Distribution of Trained Teachers According to Marital Status.

Table 26. Distribution of Headmasters by Sex.

Table 27. Distribution of Headmasters by Age.

Table 28. Distribution of Headmasters According to Marital Status.

Table 22. Distribution of Untrained Teachers by Sex.

Sex	N	%
Male	31	57.4
Female	23	43.6
Totals	54	100.0

Table 23. Distribution of Untrained Teachers According to Marital Status.

Marital Status	N	%
Single	49	90.7
Married	5	9.3
Separated	0	0.0
Widowed	0	0.0
Divorced	0	0.0
Totals	54	100.0

Table 24. Distribution of Trained Teachers by Sex.

Sex	N	%
Male	47	71.2
Female	19	28.8
Totals	66	100.0

Table 25. Distribution of Trained Teachers According to Marital Status.

Marital Status	N	%
Single	23	34.8
Married	27	41.0
Separated	5	7.6
Widowed	8	12.1
Divorced	3	4.5
Totals	66	100.0

Table 26. Distribution of Headmasters by Sex.

Sex	N	%
Male	14	93.3
Female	1	6.7
Totals	15	100.0

Table 27. Distribution of Headmasters by Age.

Age	N	%
25 and below	0	0.0
26-35	1	6.7
36-45	9	60.0
46-55	3	20.0
56 and over	2	13.3
not sure	0	0.0
Totals	15	100.0

Table 28. Distribution of Headmasters According to Marital Status.

Marital Status	N	%
Single	0	0.0
Married	12	80.0
Separated	0	0.0
Widowed	2	13.3
Divorced	1	6.7
Totals	15	100.0