

THE UNIVERSITY OF MANITOBA

AN EXPERIMENTAL STUDY OF THE EFFECTS ON ACHIEVEMENT OF
THE USE OF A CULTURALLY RELEVANT MATHEMATICS PROGRAM

by

GORDON DAN REIMER

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A dissertation submitted to the Faculty of Graduate Studies of
the University of Manitoba in partial fulfillment of the requirements
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ABSTRACT

This study was designed (1) to investigate the effects on the achievement of native students, when a culturally relevant mathematics program was used, and (2) to determine if the use of such a program increased the student's level of enjoyment in mathematics, (3) to determine if students studying such a program would recognize greater value in mathematics (4) to determine if teachers believed the use of this program contributed to student enjoyment and to achievement in mathematics.

To investigate the effects on achievement, an experimental setting was used to compare the achievement of 175 grade seven students from eleven schools within Frontier School Division. This sample was divided into treatment and control groups. The first group received the culturally relevant curriculum unit, while the second group received a parallel unit based on the present authorized curriculum and texts in the Province of Manitoba. The units dealt with mathematical word problems which were developed by the writer

for this study. Using a pretest and posttest, an analysis of covariance was used to test the null hypothesis of no significant difference in achievement between the two groups.

To determine the effects of this program on student enjoyment of mathematics and the value students see in mathematics, a student questionnaire was used. This was analysed and the responses reported comparatively between the treatment and the control groups.

To determine if teachers considered the use of such a program important in student enjoyment and achievement in mathematics, two teacher questionnaires were utilized. The first was completed by all eleven teachers upon completion of the experimental study, while the second was completed by the control teachers only upon receipt of a culturally relevant curriculum unit. These were analysed and the responses reported comparatively between the treatment and control groups.

With regard to the effects on achievement of the use of a culturally relevant curriculum unit, the analysis showed (1) that students studying the culturally relevant unit scored significantly higher than students using a nonrelevant unit ($p < 0.001$); (2) that the place of residence of a student within the community (ie: reserve, off reserve, recently new to community) was not significant when comparing achievement between these categories within treatments ($p > 0.05$); (3) that the sex of the student was not significant when comparing

achievement between these categories within treatments ($p > 0.05$).

With regard to the effects on student enjoyment of mathematics, the study showed that students studying a culturally relevant unit seemed to enjoy mathematics more than students studying the culturally nonrelevant unit.

With regard to the value which students place on mathematics, there was no apparent difference between the two groups of students.

With regard to the effects of such a program on student enjoyment and achievement as perceived by teachers, the study showed (1) that teachers felt student enjoyment of mathematics would be greater with such a program as compared to a culturally nonrelevant program, (2) that teachers felt student achievement in mathematics would be greater with such a program as compared to a culturally nonrelevant program, and (3) that teachers felt more mathematics should be presented in such a culturally relevant manner.

The study indicated a need for the development and use of mathematics materials, units, and programs culturally relevant for native students in northern Manitoba.

TO MY WIFE

M A R I E

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I wish to express my sincere appreciation
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CHAPTER I

INTRODUCTION

I. THE NEED FOR THE STUDY

The significance of this study lies in the concern many educators have about the low achievement and high dropout rate of Native students as compared to Non-native students within the public school system in Canada. The difference in achievement is clearly reflected in the dropout rates of the two groups. In a study at the national level conducted by Hawthorn (1967), the dropout rate for Native students from Kindergarten to Grade Twelve was found to be twelve percent annually. Kirkness (1973) projected a Manitoba based study to the 1974-75 school year and predicted ninety-one percent dropout on the basis of figures available on Native students at that time. In studies conducted by Goucher (1967) and Kirkness (1973) the dropout rate in Native schools and the dropout rate for Native students in integrated schools was found to be many times that of the rest of the population.

Many educators feel that low achievement, which is a factor in the high dropout rate, is in part due to the use of curriculum in both all Native and integrated schools that does not take into account the culture of the Native student. In a book entitled The Disadvantaged, Fantini (1968) related the dropout rate to the level of achievement. Fantini also

related achievement, which was measured by the grade achieved prior to leaving school, to a curriculum that was culturally relevant for the student.

Berger (1972) conducted a study in Alberta and found that the nine Native families studied placed the highest priorities on "culture" and "education" given a list of thirteen topics of concern.

In view of the suggested relationship between dropout, achievement, and cultural relevance, many educators have contended that the development of culturally relevant curriculum materials be made a matter of priority. Such educators have also contended that new materials should be developed in literature, social studies, art, science, and mathematics.

This study attempts to ascertain whether or not a relationship between achievement and cultural relevance does exist in a particular curriculum area.

II. THE IMPORTANCE OF THE STUDY

Achievement in school depends to a considerable extent on the achievement each student experiences in mathematics. Since development of a student's skills in mathematics is one of the important tasks of the public school system, the ability of students to utilize mathematical skills effectively in everyday life is an important goal for most teachers. This ability, namely to translate a problem into computational terms and then employ computational skills to solve the

problem, is one which each student must possess to some degree in order to experience achievement within the public school system and within the socioeconomic parameters of modern society.

The stated purpose of the school division in which this study was conducted is to inculcate in its students intellectual skills and knowledge as well as social skills, which will fit the students for productive, self-fulfilling lives, in or out of their communities, with an educational background that will enable them to compete on equal terms with graduates from any other public school system. Unless this purpose is achieved the students of Frontier School Division, most of whom are Native students, will fill the ranks of the unemployed rather than making the contributions of which they are capable to the economic, cultural and intellectual life of Manitoba.

In order to assure that the best possible education has been made available to the students of Native ancestry the possibility of culturally relevant education having an effect on achievement should not be left to chance.

III. THE PURPOSE OF THE STUDY

The purpose of this study was to ascertain, whether or not under experimental conditions, achievement in mathematics would increase when a culturally relevant program of studies in mathematics was used.

To determine this, a curriculum unit in mathematics was developed and then translated into culturally relevant terms for students in northern Manitoba. The two resulting units were then utilized in the experimental part of the study.

IV. QUESTIONS

Following are the questions to be answered by the study:

1. Do students at the grade seven level in mathematics using a culturally relevant mathematics curriculum unit show greater achievement than students using a culturally non-relevant mathematics curriculum unit?
2. Do students enjoy mathematics more if a culturally relevant mathematics curriculum unit is used rather than a culturally nonrelevant mathematics curriculum unit?
3. Do students see a greater value in mathematics if a culturally relevant mathematics curriculum unit is used rather than a culturally nonrelevant mathematics unit?
4. Do teachers using a culturally relevant mathematics curriculum unit consider their unit to be more important in student enjoyment and achievement than do teachers using a culturally nonrelevant mathematics curriculum unit?

Question one, as stated above, will be answered by the experimental portion of this study, while the remaining questions will be answered by a descriptive analysis of

several student and teacher questionnaires.

V. DEFINITIONS OF TERMS

The following are definitions of terms as they were used in this study.

Achievement: In this study "achievement" refers to the level or degree of excellence attained 1) within a grade, 2) within a course, 3) within a unit of study within a course. In the "Review of Related Research and Literature" (Chapter II) achievement may also refer to the grade level attained prior to the discontinuance of formal education in the public school system.

Culture: In this study "culture" refers to all the knowledge, beliefs, customs, and skills a person acquires as a member of society. It refers to the "way of life" in the communities in which the student lives who is taking part in this study. This then differentiates "culture" from "cultural heritage" which refers to the way in which cultures of the past have contributed to culture as it is today.

Cultural Awareness: In this study "cultural awareness" means more than the acknowledgment of the existence of another culture. It also includes the acceptance of that culture as a valid system and at the same time makes an attempt to take into account, in any contact with that culture, the available knowledge concerning that culture.

Culturally Relevant: In this study "culturally

relevant" refers to the characteristics of the curriculum unit the author has developed in which an attempt has been made to take into account the culture of the student involved in this study.

Curriculum: In this study "curriculum" refers to any planned activities including courses which the student participates in under the direction of a school.

Curriculum Unit: In this study specific reference will be made to the "curriculum unit" which the author has developed. This is the curriculum unit that has been used in the experimental part of this study. It consists of a mathematics unit involving word problems only, at the grade seven level.

Dropout: In this study "dropout" refers to any student who having once enrolled in school discontinues before graduation from grade twelve for reasons other than
1) transfer to another school, 2) physical injury or death,
3) the inaccessibility of schools for further education.

Native Student: In this study "native student" refers to any students, Indian or Metis, Treaty or Non-treaty, within the scope of this study that are of Indian descent.

Student: In this study "student" refers to any subject in this study who is registered in the schools in which the study is being conducted. More specifically this group of students consists of three categories, those that live on a reserve, those that do not live on a reserve but who have

been long term residents in the community, and those who do not live on a reserve and are short term or recent residents of the community. In this last group would be all those residents who are not indigenous to the community.

VI. LIMITATIONS OF THE STUDY

There are a number of limitations to this study. The writer is aware of the restrictive nature and scope of his topic; this choice, however, has been deliberate. The nature and scope of the study imply that the results of the study need not reflect on any other grade level, any other school, any other subject, or any other area of mathematics beyond that used in this study.

1. This study was limited to the grade seven students, in the schools randomly selected for the study.

2. This study was limited to randomly selected schools located within the confines of Frontier School Division #48 of the Province of Manitoba.

3. This study was limited to the mathematics curriculum units developed and used in the study which dealt only with word or story problem types.

VII. LOCATION OF THE STUDY

This study was conducted within Frontier School Division #48 in the Province of Manitoba. The Division was established in July, 1965. Prior to this date the schools

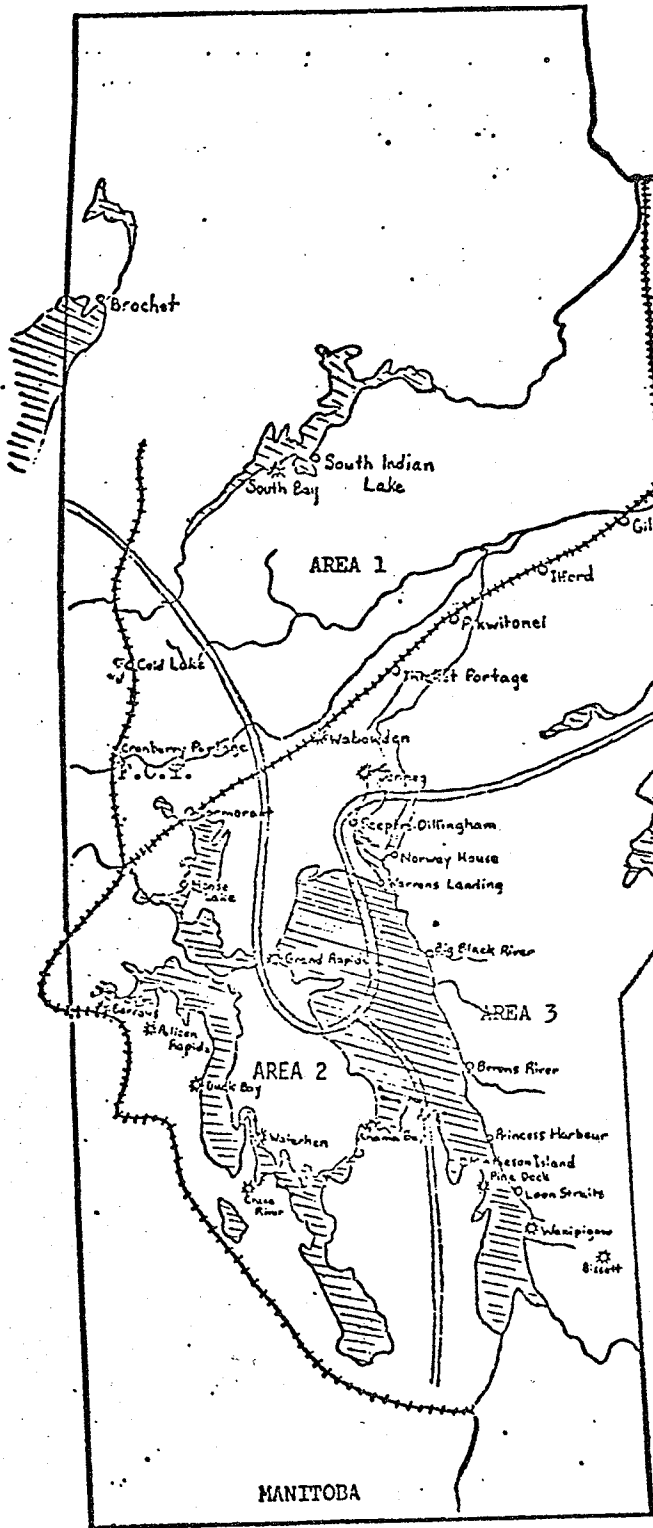
now comprising the Division were administered in a variety of ways. The intention of the reorganization was to facilitate the coordination of efforts to improve education in isolated communities.

Many of the communities do not have a viable economic base. Most of the residents are of Native ancestry, either treaty or non treaty. The adults of the communities earn a livelihood by fishing, trapping, lumbering, employment with Manitoba Hydro, or gain employment with local businesses such as stores, motels and service stations. Unemployment is a continuing problem in many of these communities.

The isolated communities that comprise the Division are scattered over approximately two-thirds of the geographical area of the Province. They are located largely in the Canadian Shield country and range from the southern shores of Lake Winnipeg in the South-East of Manitoba to Brochet in the North-West corner of the province. Within the boundaries of this geographical area there are enclaves which are not part of Frontier School Division. These consist of large towns and cities which operate their own school systems such as The Pas, Flin Flon, Thompson, Leaf Rapids, Snow Lake, and Churchill. In addition, there are numerous Indian Reserves which operate schools under the authority of the Federal Department of Indian Affairs and Northern Development.

FRONTIER SCHOOL DIVISION #48
 (Established July, 1965)

Head Offices Located at
 507 - 1181 Portage Avenue
 Winnipeg



- Area 1 Office - Thompson
- Area 2 Office - Dauphin
- Area 3 Office - Winnipeg

FRONTIER COLLEGIATE - Cranberry Portage

Accessible by Road ☉
 Railway +++

VIII. EXPERIMENTAL HYPOTHESIS

The following three hypothesis relate to Question One posed earlier in this chapter:

Hypothesis 1: There are no significant differences in the levels of achievement between students studying a culturally relevant mathematics curriculum unit and those studying a culturally nonrelevant mathematics curriculum unit.

Symbolic Representation

$$H_0: u_1 - u_2 = 0$$

Legend: Treatment groups
 1. culturally relevant
 2. culturally nonrelevant

Hypothesis 2: There are no significant differences in the levels of achievement between male or female students studying a culturally relevant mathematics curriculum unit and male or female students studying a culturally nonrelevant mathematics curriculum unit.

Symbolic Representation

$$H_0: \begin{Bmatrix} u_{1,3} \\ u_{1,4} \end{Bmatrix} - \begin{Bmatrix} u_{2,3} \\ u_{2,4} \end{Bmatrix} = 0$$

Legend: Treatment groups
 1. culturally relevant
 2. culturally nonrelevant

- Sex Groups
 3. male students
 4. female students

Hypothesis 3: There are no significant differences between population groups of students studying a culturally relevant mathematics curriculum unit and population groups of students studying a culturally nonrelevant mathematics curriculum unit.

Symbolic Representation

$$H_0: \begin{Bmatrix} u_{1,5} \\ u_{1,6} \\ u_{1,7} \end{Bmatrix} - \begin{Bmatrix} u_{2,5} \\ u_{2,6} \\ u_{2,7} \end{Bmatrix} = 0$$

Legend: Treatment groups
 1. culturally relevant
 2. culturally nonrelevant

Population Groups
 5. students resident on reserves
 6. students resident off reserves
 and indigenous to the community
 7. students resident off reserves
 and not indigenous to community

IX. ORGANIZATION OF THE THESIS

Presented in Chapter I was the statement of the need for the study. The importance of the study was followed by the purpose of the study. Questions to be answered, definitions of terms, and limitations, as well as the location of the study, were presented.

Chapter II includes an overview, a review of the literature related to this study, and a summary of the literature pertinent to the study.

In Chapter II the methods, procedures and design of the study are examined in detail. Specifically, the description of the population and selection of the sample, description of the treatments and questionnaires, the research design, and the procedures of the investigation are presented, as well as the methods for analysis of the data.

In Chapter IV the analysis of the data and reports of the findings are presented.

Finally in Chapter V are recorded a summary of the findings, conclusions based on the study, implications arising out of the study, and recommendations for future research.

CHAPTER II

A REVIEW OF RELATED RESEARCH AND LITERATURE

The research and literature describing studies in the area of mathematics and the Native student was found to be limited. If the scope of this review had been expanded to include all available research and literature on mathematics and the so called "disadvantaged" a dearth would still have been found to exist. Suydam (1971) reporting on research in this area said:

All in all, research has given us limited guidance in knowing how to provide the most effective mathematics programs and instructions for disadvantaged students. Little of the knowledge we do have regarding such students comes from research conducted explicitly within the context of mathematics education. (Suydam, 1971. p.1)

In an attempt to establish the context for the present study this review considered literature related to education and the culturally different; mathematics and the culturally different; education for cultural awareness; the curriculum as a factor in failure for the Native student; the need for a different curriculum for the Native student.

The term "disadvantaged" was found to be used in many different ways, to suit many different situations. Suydam (1971) pointed out two categories of "disadvantaged" the "environmentally" disadvantaged and the "academically" disadvantaged. The environmentally disadvantaged included such cultural factors as socio-economic level or migrant

status. Also included was the community or location within a community where the student lived, and the ethnic origin of the student. The academically disadvantaged included such factors as intellectual ability and achievement. This included the "low achiever" with an IQ of 75 to 90. It also included the "underachiever" who appeared to have the ability to achieve at a higher level but who failed to do so.

The writer recognized that the reasons for a student or a group of students being referred to as "disadvantaged" were many. In this review the literature pertaining to or speaking of the disadvantaged within a cultural context was considered. Literature relating to other categories of the disadvantaged was also referred to but only as it spoke to or had implications for the disadvantaged within a cultural context. Consequently, the writer used the term "culturally different" rather than "culturally disadvantaged".

I. LITERATURE RELATED TO EDUCATION AND THE CULTURALLY DIFFERENT

A cartoon published in the New Yorker (Howe, 1968) depicted what has happened to education for the "disadvantaged". The cartoon showed an Indian father reading a bedtime story to his son in the family teepee. He read:

And just then, when it appeared that the battle was lost, from beyond the hills came the welcome sound of war whoops."

Textbooks used in schools tend to present anything involving