STATEMENT OF PERMISSION TO COPY

In presenting this paper in partial fulfillment of the requirements for an advanced degree at Montana State University, I agree that the Library shall make it freely available for inspection. I further agree that permission for extensive copying of this paper for scholarly purposes may be granted by my major professor, or, in his absence, by the Director of Libraries. It is understood that any copying or publication of this paper for financial gain shall not be allowed without my written permission.

Signature Alice Vucevich

Date May 25, 1978

COMPARISON OF MATHEMATICAL ACTIVITIES FOR GIFTED SIXTH GRADERS

by

ALICE GERALDINE VICEVICH

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF EDUCATION

with concentration in

Elementary Administration

Approved:

James G. Hamwiller
Chairperson, Graduate Committee

Head, Major Department

Henry L Parsons
Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

June, 1978

ACKNOWLEDGEMENTS

The author is indebted to Dr. James Hauwiller of the Elementary Education Department at Montana State University for his time, valuable criticism and advice. The writer is also grateful to Dr. Lawrence Ellerbruch for assistance in the computer computation of the data and the interpretation of the results.

Gratitude is extended to Donna Silverman, mathematics teacher of the gifted sixth graders, for collecting data necessary for this investigation.

The author is also thankful to her husband, Louis, for his contribution in making this study possible.

TABLE OF CONTENTS

VITA ii

ACKNOWLEDGEMENTS iii

TABLE OF CONTENTS. iv

LIST OF TABLES vi

ABSTRACT vii

Chapter Page

1. INTRODUCTION 1

STATEMENT OF THE PROBLEM 3

APPLICATION AND CONTRIBUTION TO EDUCATION. 3

GENERAL QUESTIONS TO BE ANSWERED 4

GENERAL PROCEDURE. 5

DELIMITATIONS. 5

DEFINITION OF TERMS. 6

SUMMARY. 8

2. REVIEW OF RELATED LITERATURE 10

CONCEPTS OF GIFTEDNESS 10

IDENTIFICATION OF GIFTEDNESS 12

SPECIAL EDUCATIONAL PROGRAMS FOR THE GIFTED. 17

NEW APPROACHES TO CURRICULUM DEVELOPMENT FOR THE GIFTED. . . 22

SUMMARY. 25

3. PROCEDURE. 29

POPULATION DESCRIPTION AND SAMPLING PROCEDURE. 29

DEFINITIONS OF THE CATEGORIES OF INVESTIGATION 30

METHOD OF COLLECTING DATA 31

ORGANIZATION OF THE DATA. 42

STATISTICAL HYPOTHESES. 42

ANALYSIS OF THE DATA. 42

SUMMARY 43

4. ANALYSIS OF THE DATA 45

CONCLUSIONS 51

SUMMARY 52

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS. 54

CONCLUSIONS 58

RECOMMENDATIONS 59

REFERENCES. 62

APPENDIX I 65

APPENDIX II 72

APPENDIX III. 74

LIST OF TABLES

1. Wilcoxon Test for the Mean of Knowledge Activities as Compared to Comprehension Activities for the Gifted Group. 46

2. Wilcoxon Test for the Mean of the Knowledge Activities as Compared to Comprehension Activities for the Heterogeneous Group 47

3. Wilcoxon Test for Matched-Pairs of Activities for the Gifted Group 49

4. Wilcoxon Test for Matched-Pairs of Activities for the Heterogeneous Group 50

ABSTRACT

This investigation was concerned primarily with the types of mathematical activities that are attractive to gifted students. Comparisons of knowledge activities and comprehension activities according to Bloom's Taxonomy were made to determine if among gifted sixth grade students there was a preference for higher level math activities. The same activities were also presented to sixth graders in a heterogeneous group to determine if they had a preference for higher level math activities.

Data were collected from 42 sixth grade students identified to participate in a gifted program in a large school district in a particular city in southwestern Montana, as well as from 19 sixth grade students in a heterogeneous group in the same city and school district. Both groups rated the same four pairs of the two types of activities on a scale from 1 to 5 with one being the less attractive and five being the more attractive. The Wilcoxon matched-pairs, signed-ranks test for two correlated samples was used to test the hypotheses.

For the group of gifted students the results showed a preference for mathematical activities involving comprehension rather than mathematical activities involving knowledge. For the heterogeneous group, preference for comprehension activities rather knowledge activities was not demonstrated.

Chapter 1

INTRODUCTION

In the early 1900's after the development of the intelligence test and Lewis Terman's vigorous use of it in his study of genius, the concept of intellectual giftedness assumed a central place in education and psychology. As early as the 1920's this concept of giftedness was being questioned. It was proposed not to use the term gifted without qualifying it with "mentally," "aesthetically" or "physically" (Getzels, 1976:690-691).

The post World War II period was one of growing curiosity about the nature of giftedness and resulted in an extraordinary deluge of literature. There was a shift in research in the late 1950's and emphasis began to turn from intellectual giftedness as defined by I.Q. to creativity which became the major interest in the study of superior mental functioning. The most recent conception of giftedness also includes various talents such as the social, aesthetic, and mechanical. These superior specific abilities are valued by society but are not necessarily included in the general categories of creativity and intelligence (Getzels, 1976:693).

The conception of giftedness is as complex as the individual who possesses it. There are a variety of kinds of giftedness to be cultivated and if a level is established on some single measurement, we eliminate many extremely gifted individuals on other measures of

giftedness (Torrance, 1965:2).

Ignoring giftedness within children because of its complexity may not be the best alternative. The preservation of our way of life and the future security of our country depend upon our intellectual and creative abilities which is our most important natural resource (Guilford, 1956:292).

Until recently it was assumed that the needs of the gifted were well served by our educational system. During the past decade American educators have had a change of attitude toward these special children, however and, because of support from federal, state and local agencies, new instructional programs are being developed.

Using Bloom's "Taxomony of Educational Objectives" the California State Department in their Educational Objectives for Teaching the Mentally Gifted suggested the following creative and cognitive abilities that should be developed with gifted students: 1. translation, 2. interpretation, 3. extrapolation, 4. application, 5. analysis, 6. synthesis, and 7. evaluation.

Ruth Arent stated at the National Conference on the Gifted and Talented in Denver, Colorado:

> Adjust content and curriculum which will accept that there are special curriculum considerations for the gifted students. He must have skills, achievements and provisions for higher cognitive thinking. This entails problem solving, inquiry, discovery, simulation and creativity (1967).

There have been major curriculum changes in the area of

mathematics. The nature of this subject matter cries out for individualization of instruction so the gifted youngsters can master the abstract concepts as rapidly as his capabilities permits without being delayed in his progress by the calculations of simple-minded or practical problems created for the less gifted learner (Gallagher, 1975:95).

This investigator believes that the inclusion of mathematical activities on the higher levels of cognitive thinking according to Bloom's "Taxonomy of Educational Objectives" in the mathematics program for the gifted will make this curriculum area more attractive to the students.

STATEMENT OF THE PROBLEM

The problem of this study was two-fold: (1) to determine if among gifted sixth grade students there is a preference for comprehension activities as compared to knowledge activities on selected math topics, and (2) to determine if among sixth grade students in a heterogeneous group there is a preference for comprehension.

APPLICATION AND CONTRIBUTION TO EDUCATION

This study was conducted so the educational needs of gifted children may be more adequately met. The knowledge obtained from it may be helpful in developing an effective mathematics program for these

children. Mr. S. P. Marland, U. S. Commissioner of Education (1971) in his report to the Congress of the United States justifies this type of research. Mr. Marland (1) stated:

> We know that gifted children can be identified as early as the preschool grades and that these children in later life, often make outstanding contributions to our society in the arts, politics, business, and the sciences. But, disturbingly, research has confirmed that many talented children perform far below their intellectual potential. We are increasingly being stripped of the comfortable notion that a bright mind will make its own way. Intellectual and creative talent cannot survive educational neglect and apathy.

Mr. Marland also stated (1971:94)

> Modern changes toward increasing urbanization and complexity demands increasing skills in adaption. Societal needs for highly educated and highly skilled persons are increasing. Conservation as a social priority includes human conservation; the conservation of the gifted and the talented requires that society tolerate the right of the individual with exceptional abilities and talents, even though unconventional, to attain the goals he seeks. Benefits we extend our present encouragement of the athlete to excel to all other fields of endeavor.

GENERAL QUESTIONS TO BE ANSWERED

1. Are mathematical activities involving comprehension more attractive to gifted sixth grade students than mathematical activities involving knowledge?

2. Are mathematical activities involving comprehension more attractive to heterogeneously grouped sixth grade students than mathematical activities involving knowledge?

GENERAL PROCEDURE

The total population of forty-two sixth grade pupils who were identified to participate in a gifted program in a large school district in a particular city in Southwestern Montana were the subjects of this study. A second group consisting of nineteen sixth graders in a heterogeneous class in the same city and school district was also used in the study.

Both groups of students were presented four pairs of mathematical activities with each pair being introduced on two consecutive days. Each matched pairs of activities consisted of the same subject matter with one activity involving knowledge one activity involving comprehension as defined in this chapter. The students "rated" the activities at the conclusion of each pair on a scale from one to five. One indicated the less attractive and five the more attractive.

The responses of the students were organized in matched pairs. The statistical technique used to determine if there was significant preference for the higher level activities was the Wilcoxon matched pairs, signed ranks test for two correlated samples (Siegel, 1956:75-83).

DELIMITATIONS

1. This study included the forty-two sixth grade students who were identified as gifted in a particular city in a large school district in Southwestern Montana for the 1977-78 school year.

2. The nineteen students in a heterogeneous group was chosen arbitrarily by the principal in an elementary school in the same district to be in a particular classroom for the 1977-78 school year.

3. The general content area of all the math activities in the study was a series of topics within set notation.

DEFINITION OF TERMS

Gifted sixth grade students. The forty-two sixth grade students involved in this study were identified as gifted in a large school district in Southwestern Montana during the 1976-77 school year. The following instruments were used in identification process:

1. Group intelligence tests.
2. Achievement tests - composite scores in mathematics and reading.
3. Peer recognition form.
4. Teacher recognition form.
5. Parent recognition form.

These forty-two sixth grade students were identified to participate in a program for the gifted to be implemented during the 1977-78 school year. They constitute approximately five percent of the total sixth grade enrollment in the district.

Knowledge. Knowledge is simply remembering. It is the bringing back to mind needed material to meet current situations.

Knowledge may involve relating since a situation may involve organization and reorganization of a problem in order to produce the necessary hints to recall the knowledge that an individual possesses.

Knowledge includes: (1) the bringing back to mind of specific and isolated bits of information, knowledge of the terminology which applies to a given situation and knowledge of specific facts such as dates, persons and places, (2) knowledge of stratagem in organizing, studying, judging and critizing specifics, the knowledge of the particulars in communicating ideas, the knowledge of procedures in relation to time, the knowledge of cataloging material considered basic to a particular field, the knowledge of the criterion necessary to test or judge facts, rules, presumptions and behavior and the knowledge of the methods used in a specific subject area for the purpose of investigation, (3) knowledge of large structures and generalities and organization within a particular field, knowledge of important fundamentals which condense observations of phenomena, and knowledge of theories and principles which demonstrate a lucid perception of complex material.

Comprehension. Comprehension is the lowest level of understanding. The person knows what is being transmitted to him and can make use of the communicated material without seeing its complete application to other materials or fields.

Comprehension includes the following:

1. Translation is the ability to paraphrase or translate a communication from one form to another or state and abstract idea in concrete form.

2. Interpretation is the giving of one's own meaning to a communication. It may be a summary or reorganization of communicated material to relate it to one's own experience.

3. Extrapolation is the extending given data to make predictions, drawing conclusions or hypothesizing and listing possible outcomes, also inserting new material where gaps exist in the data.

The condensed version of these terms as taken directly from Taxonomy of Educational Objectives, The Classification of Educational Goals; Handbook II; Cognitive Domain, edited by Benjamin S. Bloom, can be found in the Appendix I.

SUMMARY

There has been a rapid development in the concept of giftedness since the early 1900's. This development has resulted in a change of attitude toward the education of gifted children in our country. Recognizing the fact that the educational needs of these children are not being met by our system many new programs are being developed in their behalf. Educators and statesmen realize that society will greatly benefit if the potential of these special individuals is nurtured.

Comparisons of comprehension activities and knowledge activities

according to Bloom's "Taxonomy of Educational Objectives" were made to determine if among gifted sixth grade students there is a preference for higher level math activities. The purpose of the study is to lead to knowledge that may be instrumental in curriculum improvements for these special youngsters.

Chapter 2

REVIEW OF RELATED LITERATURE

During the past two decades, American education has witnessed a change of attitude toward the gifted. Special instructional programs of these youngsters are on the rise as educators receive greater support from federal, state and local agencies. This review will explore the concept of giftedness, identification of gifted children, and special educational programs for the gifted for the purpose of providing improvements in curriculum for these students.

CONCEPTS OF GIFTEDNESS

In the early twentieth century the term "gifted" was most commonly associated with high intelligence. It was the development of the intelligence test and Lewis Terman's vigorous use of it in his influential study of genius that gave this conception of giftedness its central place in education. All of the subjects in Terman's longitudinal test of 1500 gifted students had intelligent quotients of 140 or above. Terman stated:

> Granting that both interest and special aptitudes play important roles in the making of a gifted scientist, mathematician, mechanic, artist, poet or musical composer, I am convinced that to achieve greatly in almost any field, the special talents have to be backed up by alot of Spearman's g by which is meant the kind of general intelligence that requires ability to form many sharply defined concepts, to manipulate them, and to perceive subtle relationships between them; in other words, the ability to engage in abstract thinking (Terman, 1954:222).

As early as the 1920's, however, this concept of giftedness was being questioned. It was proposed not to use the term gifted without qualifying it with "mentally," "aestetically," or "physically," or without including the social and moral as well as mental development. So some alternately speak of distinct concepts of giftedness in respect to the ability specified, whether intellectual or nonintellectual. One can further distinguish within the intellectual abilities between high I.Q. and high creativity; and within the nonintellectual, among various talents such as the social, aesthetic, and mechanical (Getzels, 1976:690).

Getzels (1976:694) categorized the concepts of giftedness into three major categories: (1) superior ability in intelligence (2) superior ability in creativity, and (3) superior ability in the variety of human talents.

Despite the growing body of literature concerning intellectual processes being closely allied to the general concept of "creativity", there is a tendency to treat this concept as applicable only to performance in one or more of the arts. Thus "creative child" has become synonymous with the expression "child with artistic talents" and in effect limiting the attempts to identify and foster cognitive abilities related to creative functioning in areas other than the arts (Getzels, 1958:75).

From an overview of literature it is evident that the concept

of giftedness is as complex as the individual who possesses it. There are a variety of kinds of giftedness to be cultivated and if a level is established on some single measure of giftedness, we eliminate many extremely gifted individuals on other measures of giftedness. Intelligence too may increase or decrease, depending upon available methods of measuring it as well as a variety of physical and psychological factors both within the individual child and within his environment (Torrance, 1965:2).

However, ignoring giftedness within children because of its complexity may not be the best alternative. Guilford (1956:292) claimed that the preservation of our way of life and the future security of our country depend upon our intellectual and creative abilities which is our most important natural resource.

IDENTIFICATION OF GIFTEDNESS

Who then are the gifted? How can they be identified? Are they really sufficiently deviated from the norm to warrant special attention? What are they like?

Before Terman conducted his study of intellectually superior individuals the stereotypes of precocious children were that they boardered on insanity. These children were psychotic or otherwise abnormal and were sure to burn themselves out or to develop post-adolescent stupidity (Terman, 1954:222).

It is not an uncommon belief now that the "quiz kid" is the "queer kid", physically immature, socially maladjusted, emotionally unstable and morally untrustworthy (Getzel, 1976:694).

Terman (1954:222) found in his study, however, that his subjects with an I.Q. of 140 or above were in general appreciably superior in physique, health, and social adjustment; markedly superior in moral attitudes as measured either by character tests or by ratings; and vastly superior in their mastery of academic subjects.

Marland (1971:16) contended that most superiorly gifted individuals experiece difficulties especially in their early school years. Because their ideas differ from other children of their same age, they lose the participation of others in their activities and find themselves marginal and isolated. In the large population of gifted children these young children have the highest incidence of poor peer relationships. The author attributes this to lack of experience in adapting to requirements, in coping with frustration and having available to him suitable substitute activities, as an older child would.

These precocious youngsters, Marland continued, when given the opportunity to satisfy their desires for knowledge and performance, experience a greater sense of adequacy and well-being.

Gifted children in general seem to differ from the normal in still other respects. They depart from self-centered values and concerns and are plagued by problems of morality, religion, and world

peace earlier than their chronological peers. Of all human groups the gifted are least likely to form stereotypes because they possess unlimited versatility (Marland, 1971:16).

Gifted children are defined by Marland (1971:10-11) for the purpose of identifying them for federal education programs as follows:

> Gifted and talented children are those identified by professionally qualified persons who by virtue of outstanding abilities, are capable of high performance. These are children who required differentiated educational programs and/or services beyond those normally provided by the regular school program in order to realize their contribution to self and society.

In clarifying what he meant in his definition by children capable of high performance, Marland (1971:10-11) included those that showed outstanding achievement and/or potential ability in any of the following areas either singly or in combination:

1. General intellectual ability
2. Specific academic aptitude
3. Creative or productive thinking
4. Leadership ability
5. Visual and performing arts
6. Psychomotor ability

Using the above criteria it can be assumed that three to five percent of the school population will be identified as gifted.

Two essential components of identification are objective measures and professional evaluation measures. Professional qualified persons are defined by Marland as follows:

> Professionally qualified persons include such individuals as teachers, administrators, school psychologists, counselors, curriculum specialists, artists, musicians, and others with special training who are also qualified to appraise pupils' special competencies.

Torrance (1965:19) substantiated this view when he stated that procedures and goals for identifying gifted children become clearer if the objective is to search for indications of giftedness which could result in outstanding achievements of value to society if given intelligent guidance and encouragement.

Many local, state, and regional agencies have studied possible procedures for identifying children with unusual potential. The Southern Regional Education Board through its Project of Education for the Gifted, headed by Virgil Ward (1962) came up with this list of seven types of data as indicators of giftedness:

1. Group intelligence test
2. Teacher judgment
3. School record, including achievement test scores and teacher grades
4. Individual intelligence test administered by a qualified person
5. Appraisal of social and emotional maturity and adjustment
6. Parent interviews
7. Pupil ambition and drive (Torrence, 1965:23).

One major problem in the process of identification is the possibility of over-looking the exceptionally creative child. Taylor (1962:423) in discussing this difficulty claimed that traditional I.Q. tests at best accounts only for a minor portion of the variation in creative performance. The author expressed deep concern for these

students, stating that there can be a decrease in creative talent within these individuals as they move along the academic ladder and this may result in an above average drop out. Early evidence suggests that fellow students and teachers may not favor, in fact they may disfavor, the more creative students.

Ward's committee also cautioned that teachers have a tendency to recognize as gifted, the more conforming children who are attractive, ambitious, and well-behaved, and other overlook the non-conforming, ill-mannered, unattractive creative children (Torrence, 1965:23).

Renzulli and Hartman (1971:211-14) stated that a comprehensive review of literature up to this time reveals a "frighteningly low" level of effectiveness of unstructured teacher judgment as a basis for identification of gifted students. They developed the "Scale for Rating Behavioral Characteristics of Superior Students" (SRBCSS), which is an attempt to provide a more objective and systematic instrument that can be used as an aid in guiding teacher judgment in the identification process. The authors emphasized the (SRBCSS) is meant to be used as a supplementary means in conjunction with other criteria for identification.

Pegnato and Birch (1959:300-304) reported the results of their study to determine relative efficiency and effectiveness of seven different types of data indicators in identifying gifted junior high students. The seven indicators in the screening process were:

1. Teacher judgment
2. Honor roll listing
3. Creative ability in art and music
4. Student council membership
5. Superiority in mathematics
6. Group intelligence test results
7. Group achievement test results (Pegnato and Birch, 1959: 300-304).

The authors concluded that taken together, the group intelligence test results and the achievement test results proved to be the most effective screening procedure.

From the overview of literature, the researcher concluded that each indicators used in the identification procedure has its shortcomings and in conclusion contended Torrence (1965:24):

> In the most successful programs for gifted children with which the author is familiar, those responsible for them have usually decided what kind or kinds of giftedness they want to cultivate, selected students on this basis, and set about trying to develop programs which will capitalize upon the characteristics of giftedness which have been used in selection.

SPECIAL EDUCATIONAL PROGRAMS FOR THE GIFTED

Special educational programs for the gifted within the school can be classified as administrative, instructional or adjunctive. Administrative programs changes the educational world about the child; the instructional program changes the content of the subject matter or the method in which it is presented; adjunctive program provides special services beyond the usual school services such as counseling or special tutoring (Getzels, 1976:714-15).

The traditional curriculum provisions for the gifted are generally categorized in the research literature under the headings of Enrichment, Grouping and Acceleration. The school provides special opportunities and makes special materials available to the gifted in the regular class situation, by grouping them into homogenous classes, or by accelerating them through the hierarchy of grades and courses (Getzels, 1976:715).

Enrichment became popular in the early 1930's when psychologists and educators decided that it is better to keep a child in his own age group than to segregate him or accelerate him. Consequently, the term began to be used specifically to designate those provisions of different learning experiences in the otherwise undifferentiated or heterogeneous classroom. Evaluation of these programs were generally favorable but they were based on the opinion of those involved in the programs rather than upon experimental evidence (Getzels, 1975:715).

Torrence substantited this when he stated that of the three programs enrichment has been the most generally approved but its advocates have not been able to produce as good research support as have the advocates of homogeneous groups and acceleration (1965:40).

Torrence felt though, that in practice the concepts of enrichment could be improved and better implemented. He suggested that there is a need to differentiate what is enrichment for each individual child. He also claimed there is a need to provide plenty of

opportunities with unlimited possibilities to challenge the capabilities of different kinds of gifted children (1965:40).

It is almost impossible to see how anyone can be against enrichment since it basically means adjusting instructions to meet the needs of each individual child. So the question is whether it is more advantageous to provide enrichment in a regular classroom or to group the gifted into homogenous classes, or to accelerate these brighter students (Getzels, 1976:715-16).

Grouping, that is placing students in special classes or tracks according to ability or preference, has been the subject of prolonged and sharp controversy revolving as much around democratic issues as about the effectiveness of grouping while others argue that such a practice produces an intellectually elite through an educational caste system (Getzels, 1976:716).

In response to the objection that special provisions for the gifted and talented are undemocratic, Marland in his report to Congress replied:

> If democratic educational practice is interpreted as the same education for all, the answer is yes. If we believe that democratic education means appropriate educational opportunities and the right to education in keeping with one's ability to benefit, the answer is no. If one takes the affirmative stand, then all special educational programs would disappear, and hundreds of millions now expended by the states and federal government would be diverted to other uses. Other facets of the question than the philosophical, however, have been examined in research. Among these is the waste of talent, sometimes brought on by the extra control required to adjust to pressures in society. Lifelong contributions will be advantageous to the society as a whole. Rather than argue

> that special planning is undemocratic, one might conclude that special planning should be carried on for the benefit of the democracy (Marland, 1971:25-26).

Getzels stated that conclusions based on the considerable amount of research on homogeneous versus heterogeneous grouping are contradictory. We have not heard the last of the controversy with regard either to the social desirability of grouping or its effects upon achievement. He concluded by saying that achievement seemed to improve only when grouping is accompanied by differentiation in teaching quality, curriculum, guidance and method and it is therefore a helpful but not an automatically effective instructional adjustment (1975:716).

Torrence reported that research on ability grouping as crude and as undifferentiated as it has been, has generally shown that the achievement of gifted children in homogeneous groups tends to be somewhat greater than in heterogeneous groups. He also agreed with Getzels as stated above that grouping is helpful but does not automatically solve the problem of individualizing instruction.

Marland recommended the need for some kind of grouping in the following statement taken from his report:

> From all available evidence, some kind of grouping is needed for the nurture of the abilities and talents of the gifted, accompanied by quality control with well prepared teachers and staff members, consultant assistance, and careful evaluation. Special grouping and special planning, carefully conceived and executed, provide opportunities for the gifted to function at proper levels of understanding and performance. Those who oppose grouping have relied on opinion or poorly designed studies rather

> than available evidence. Recent studies have shown that simple administrative arrangements alone produce no change. If it is to success, any plan must include active and appropriate intervention (1965:39-40).

There is more research evidence available in favor of acceleration than of enrichment or grouping, yet it is the least employed device for educating the gifted. Acceleration enables a student to complete requirements in less time or at an earlier age than usual due to modifications in the program. Some forms of acceleration include early entrance to kindergarten through college; combining two year's work into one; skipping a course or grade; taking extra courses or summer sessions to shorten total time in school; earning college credits for high-school work; and "placing out" of certain courses by examinations (Getzels, 1975:716-17).

Pressey, who is an advocate of acceleration, warns that it should not be equated to or become synonymous with grade skipping because grade skipping is only one of several methods of acceleration - and probably the worst. He recommended multiple track plans, rapid progress sections, and the ungraded primary as preferable alternatives (1954:59).

In conjunction with their study of 450 mathematically precocious youth at John Hopkins University, Lynn H. Fox and Daniel Keating advocated grade skipping for some students. One weakness in grade skipping, however, is that students are not equally advanced in all

subject areas. Referring to the mathematically precocious subjects their verbal abilities may not be as advanced as their quantative talents. Fox and Keatings (1975:66) recommendations for these students was to combine some grade skipping with subject matter acceleration.

In spite of the fact that research results concerning the effects of acceleration have been generally favorable and have taken into consideration such factors as social adjustment as well as academic achievement, acceleration has never been very wide spread. Professional educators and layman have opposed acceleration on grounds that the students' social and emotional well-being may suffer from being placed with students who are chronologically older (Torrence, 1965:40).

The following comment of Getzels adequately summarizes the status of acceleration:

> More evidence is available in favor of acceleration than of enrichment of grouping, yet acceleration is the least practiced device for educating the gifted. . . . Apparently the cultural values favoring a standard period of dependency and formal education are stronger than the social or individual need for achievement and independence. This is an instance of the more general case one remarks throughout education: when research findings clash with cultural values the values are more likely to prevail (1975: 717).

NEW APPROACHES TO CURRICULUM DEVELOPMENT FOR THE GIFTED

Torrence believed that sound educational opportunities can be available to gifted school children under all three of the alternatives

discussed - enrichment, grouping, and acceleration. Some ideas he suggested that can be adapted for use under any of the three alternatives are the following:

> Self-initiated Learning. Providing opportunities for self-initiated learning are vital in implementing the concept of responsive environment and giving children experiences in responding constructively instead of just adapting to whatever happens.
>
> Learning On One's Own. This simply means providing opportunities for gifted students to accomplish things on their own and to learn on their own taks that are assigned by the teacher. The author claimed that there are times when it is wise to leave the planning and decision making to the student.
>
> Academic Disciplines As Ways of Thinking. This curriculum provisions exposes children to mathematics as mathematicians see it; physicas as physicists see it, and history as historians see it, etc. There are many new materials being developed using this approach. Creative students are taught to become sensitive to problems and to gaps in their knowledge. By discovery and direct observation they seek solutions to their problems. They keep records of observations and use their information in solving new problems. Different abilities are challenged when these new materials call for creative ways of thinking.
>
> The Responsive Environment. Children propelled by their own natural curiosity learn through experimenting when a resonsive environment is provided for them.
>
> Revised Concepts of Readiness. Some aspects of the curriculum can be comprehended by gifted youngsters at higher levels of complexity than has hitherto been thought possible. These children must learn to cope with failure and frustration because it is a characteristic of highly creative students to attempt tasks that are too difficult for them.
>
> Search for Self and One's Uniqueness. Gifted children need help in developing clear and realistic self-concepts because they may even hate their giftedness if it ostracizes them from their peers. This may result in a deliberate or unconscious attempt to destroy their talents (1965:41-45).

In response to the question "What is a good program for the gifted?" Marland in his report to Congress stated:

> The major thrust in American education togday is to free all

> students to learn at their own pace - and to place on them more resonsibility for their education.
>
> Such arrangements as flexible scheduling, independence of mobility, decision making and planning by pupils, the planning of curriculum based on pupil interests, use of community specialists, research seminars, and flexible time blocks have been successfully used. As educators study and evaluate various arrangements, they learn of their value for children with exceptional learning needs (1971).

Mathematics more than any other content area was affected by the curriculum research efforts of the 1960's. The reasons for this are first, it can be presented in a systematic fashion, because it is particularly amenable to organization and structure. Secondly, there was a great desire to change its content and its image because it was traditionally disliked by many students, gifted and non-gifted alike. The new battle cry was "Down with rote calculations and up with meaningfulness."

The nature of mathematical knowledge demands individualization of instruction so the bright students can climb the abstract pyramids as fast as his capabilities permit without having to stop for calculations of simple-minded or practical problems created for the slow learner (Gallagher, 1975:95).

In the area of mathematics one of the basic educational objectives for gifted students is an improved understanding on their part of more abstract concepts and systems related to mathematics. A second objectives is to help the educationally talented youngsters to realize that mathematics is not a statis subject area where everything

is known but instead an area of adventure and potential creative accomplishment. It is dependent upon the creative and innovative ideas of gifted students, scientists and mathematicians to keep the field growing (Gallagher, 1975:116).

Using Bloom's Taxonomy of Educational Objectives, the California State Department in their Educational Objectives for Teaching the Mentally Gifted suggested the following creative and cognitive abilities that should be developed with gifted students: 1. Translation, 2. interpretation, 3. extrapolation, 4. application, 5. analysis, 6. synthesis, and 7. evaluation.

In conclusion this investigator quotes Ruth Arent's statement at the National Conference on the Gifted and Talented in Denver, Colorado:

> Adjust content and curriculum which will accept that there are special curriculum considerations for gifted students. He must have skills, achievements, and provisions for higher cognitive thinking. This entails problem solving, inquiry, discovery, simulation and creativity (1976).

SUMMARY

The concept of giftedness is as complex as the individuals who possess it. It is generally divided into three major categories: (1) superior ability in intelligence, (2) superior ability in creativity, and (3) superior ability in a variety of human talents. There are a variety of kinds of giftedness to be cultivated and if a level is

established on some single measure of giftedness, we eliminate many extremely gifted individuals on other measures of giftedness.

How then can the gifted be identified for educational programs? Gifted children do deviate from the norm. They have outstanding abilities and are capable of high performance. Of all human groups they are the least liekly to form sterotypes because they possess unlimited versatility. The responsibility for identifying these youngsters falls to professionally qualified people such as teachers, administrators, school psychologists, counselors, curriculum specialists, artists, musicians and others with special training. A list of seven types of data that can be used in identifying gifted students are:

1. Group intelligence test
2. Teacher judgment
3. School record, including achievement test scores and teacher grades
4. Individual intelligence test
5. Appraisal of social and emotional maturity and adjustment
6. Parent interviews
7. Pupil ambition and drive

The traditional curriculum provisions for the gifted are categorized under the headings enrichment, grouping, and acceleration. It is impossible to see how anyone can be against enrichment since it basically means adjusting instructions to meet the needs of each

individual child. The question is whether it is more advantageous to provide enrichment in a heterogeneous class as opposed to a homogeneous class.

Grouping, that is, placing students in special classes or tracks according to ability or preference, has been the subject of prolonged controversy. The research conclusions on homogeneous versus heterogeneous grouping contradict one another. Torrence reported, however, that research has generally shown that the academic achievement in homogeneous groups tends to be somewhat greater than in hetergeneous groups. Marland claimed that for an effective academic program for gifted students grouping is a necessity.

The studies that are available support the view that acceleration enhances the academic achievement of precocious children, yet it is the least employed device for educating the gifted. Professional educators and layman have opposed it on grounds that the students social and emotional well-being may suffer from being placed with students who are chronologically older.

Torrence believed that sound educational opportunities can be available to gifted students under all three - enrichment, grouping, and acceleration. Some new approaches he suggested that can be adapted for use under any of these three are: self-initiated learning; learning on one's own; the responsive environment; revised concepts of readiness; and search for self and one's uniqueness.

There have been major curriculum changes in the area of mathematics. The nature of this subject matter cries out for individualization of instruction so the gifted youngsters can master the abstract concepts as rapidly as his capabilities permits without being delayed in his progress by the calculations of simple-minded or practical problems created for the slow learners.

Using Bloom's Taxonomy of Educational Objectives for Teaching the mentally gifted suggested the following creative and cognitive abilities that should be developed with gifted students: (1) translation, (2) interpretation, (3) extrapolation, (4) application, (5) analysis, (6) synthesis, and (7) evaluation.

This investigator believes that mathematical activities involving the higher levels of cognitive thinking according to Bloom's Taxonomy should be included in the mathematics program for gifted students because this type of activity is more attractive to these youngsters and will therefore foster a more positive attitude toward this curriculum area.

Chapter 3

PROCEDURE

This study was conducted to investigate whether knowledge activities or comprehension activities are more attractive to gifted sixth grade students. The study also investigated which of these two categories of activities are more attractive to sixth graders in a heterogeneous group.

Following a description of the characteristics of the population, this chapter explains methods of collecting and organizing the data, and the analysis of the data pertinent to the purposes of this study.

POPULATION DESCRIPTION AND SAMPLING PROCEDURE

There were two groups of sixth grade students involved in this study: (1) a gifted class, and (2) a heterogeneous class. The population of gifted students was all sixth grade students identified to participate in a special program for the talented and accelerated. This program was implemented in a particular school district in a city in Southwestern Montana for the 1977-78 school year. The students chosen to participate were identified by the school district during the preceding school year. The following instruments were used in the identification process:

1. Intelligence tests
2. Achievement tests

3. Peer recognition scale

4. Teacher recognition scale

5. Parent recognition scale

Approximately 5 percent of the total number of sixth grade students in this district, 42 children on this grade level, were chosen to participate in the gifted program.

The heterogeneous group involved in the study consisted of ninteen sixth grade students assigned by their principal to a particular classroom in a school in the same district in Southwestern Montana.

DEFINITIONS OF THE CATEGORIES OF INVESTIGATION

The following are definitions of knowledge and comprehension by Benjamin Bloom (1956). For more complete definitions refer to Chapter 1 and the direct quote from Bloom's "Taxonomy of Educational Objectives Handbook I" can be found in the Appendix I.

Knowledge. Knowledge is simply remembering. It is the bringing back to mind needed material to meet current situations.

Knowledge may involve relating since a situation may involve organization and reorganization of problem in order to produce the necessary hints to recall the knowledge that an individual possesses.

Comprehension. Comprehension involves understanding what is being communicated. The recipient of the communication can make use of the material being conveyed without necessarily relating it to

other material or seeing its fullest implication. Comprehension is the lowest level of understanding.

METHOD OF COLLECTING DATA

The students involved in this study were presented with four pairs of mathematical activities. Each pair was introduced on two consecutive days and consisted of the same subject matter. In each pair one activity involved knowledge and one activity involved comprehenson as defined in this chapter.

The following activities were used:

First pair: Subsets and supersets - Activity I (Involving Knowledge).

The children were presented with these definitions of subset and superset as taken from "Modern School Mathematics Structure and Use" by Ernest R. Duncan, Lelon R. Capps, Mary P. Dolciani, W. G. Quast, and Marilyn Zweng, copyright 1970.

Subset - A is a subset of B if the members of A are all members of B.

Superset - B is a superset of A if A is a subset of B.

Some examples of subsets and supersets were given orally and written on the chalkboard with repeated reference to the above definitions. Examples such as:

1. A = (Karen, Lisa, Helen, Sharon) and C = (Karen, Lisa,

Helen).

All the members of C are in A. We say "C is a subset of A" and write C $\subset$ A or we can say A is a superset of C and write A $\supset$ C.

2. D = (Letters of the alphabet)

E = (The vowels)

All members of E are in D. We can therefore say "E is a subset of D" and write E $\subset$ D or we can say "D is a superset of E" and write D $\supset$ E.

Then the children were assigned page 3 in "Modern School Mathematics Structure and Use". This was an exercise in matching subsets and supersets.

During the course of this lesson the students were required to repeatedly recall the definitions of subset and superset. The children were also taught the terminology which applies to this particular area of mathematics. Another requirement was to label the sets in relationship to one another calling to mind the definitions. These are functions of level I or knowledge as defined in this chapter.

Activity II (Involving Comprehension)

To introduce this lesson the children were told to think of the members of their class as set C, then to think of all the boys in their class as set B. The students were taught that B was a subset of C because all the members of B were members of C. The example of all the

girls in the class being set G was presented and that G is a subset of C because all the members of G were in C.

The children were then introduced to the concept of superset using the above examples. C is a superset of G because G is a subset of C. The students were then required to give examples of subsets using their class, set C, as a superset.

Then using attribute kits the pupils were asked to name a superset for a given set. For example if R is the set of all red shapes, the set of all shapes in the kit is a superset of R because all the members of R are in this set.

Then given a particular set such as all the yellow shapes the children were encouraged to name all the possible subsets of the set of yellow shapes.

In this lesson the students were required to use verbal communication to translate an abstract idea into concrete form. These youngsters were also encouraged to paraphrase the definitions of subset and superset and relate it to their own concrete experience. Therefore, the activities of this lesson were on the level of comprehension because it involved translation and interpretation which are subheadings of comprehension as defined in this chapter.

Second Pair: Intersection of Sets - Activity III (Involving Knowledge).

"Modern School Mathematics Structure and Use", Duncan, Capps,

Dolciani, Quast and Zweng (1970) was used in the presentation of this lesson. The children were first introduced to the definition of "intersection of sets". The intersection of A and B, written $A \cap B$ is the set of all elements that are common to both A and B. The first example was taken directly from the text:

$A = \{\text{red, orange, brown, black}\}$

$B = \{\text{yellow, purple, brown, black}\}$

$C = \{\text{colors common to A and B}\} = \{\text{brown, black}\}$

C is the intersection of A and B, and is written $A \cap B$.

Several more examples were given on the chalkboard such as:

$D = \{\text{the first five letters of the alphabet}\} = \{a, b, c, d, e.\}$

$E = \{\text{the first set of vowels}\} \{a, e, i, o, u\}$

$F = \{\text{the letters common to D and E}\} = \{a, e\}$

The pupils were drilled on the terminology and were taught to write $D \cap E = F$.

The concept of disjoint sets was also introduced by use of the definition and example in the test.

Disjoint sets are sets that have no member in common. A and B are disjoint sets.

$A = \{1, 1, 2, 3\}$

$B = \{101, 102, 103\}$

A and B have no members in common so we write $A \cap B = \{\ \}$ and A and B are called disjoint sets.

The children were then give page 4 of the text as a written assignment.

During the course of the activity the students were not required to give examples of their own but merely to recognize the intersection of sets from examples given in the text and on the chalkboard. Repeated reference was made to the definition in the book but the children were not required to paraphrase it. The children were familiarized with the terminology pertinent to this area of mathematics. They were provided with the basic method of determining the intersection of sets from two given sets. These activities are on the level of knowledge as defined in this chapter.

Activity IV (Involving Comprehension)

This lesson was introduced by having the students consider various subsets of members of their class and to determine the intersection of any two sets. For example:

$G = \{\text{the girls in the class}\}$

$B = \{\text{the brown-eyed student in the class}\}$

G intersection B are all the members that are both in G and B or the brown-eyed girls in the class.

After several examples using the members of the class the children were given attribute kits to demonstrate concretely the meaning of intersection of sets. While working with the attribute kits the students were encouraged to express verbally what they had done after

each example. This necessitated the paraphrasing of the definition of intersection of sets. They were also required to record their results using mathematical symbols.

These activities are on the level of comprehension as defined in this chapter because paraphrasing the definition as well as translating the communication from one form to another were required. The students also had to express an abstract idea in concrete form and reorganize the material in order to relate it to their own experience.

Third Pair: Union of Sets - Activity V (Involving Knowledge)

The children were introduced to the definition of "union of sets" taken from "Modern School Mathematics Structure and Use," Duncan, Capps, Dolciani, Quast and Zweng (1970).

The union of A and B, written A $\cup$ B is the set of all the elements that are in A or in B.

The first example was then taken from the text:

A = {red, orange, brown, black}

B = {yellow, purple, brown, black}

D = {red, orange, yellow, purple, brown, black} = {colors that are in A or B}

D is the union of A and B, and is written A $\cup$ B. Since we do not repeat members of a set, brown and black appear only once in A $\cup$ B.

Several more examples provided by the teacher were presented on the chalkboard. The definition was repeatedly called to mind so that

the students could mechanically derive the "union of sets" from two given sets.

The children were then assigned the exercises on page 5 in the text which involved the naming of the "union of sets" from two given sets in the book.

This activity was on the level of knowledge as defined in this chapter because the children were taught the basic method of determining the "union of sets" from two given sets by continually recalling the definition from the text. The students were also introduced to the terminology for this area of mathematics.

Activity VI (Involving Comprehension)

This lesson was presented by having the students think of subsets of their class. For example:

F = {all members of the class that are football players}

B = {all the blue-eyed members of the class}

Then the children were taught that the union of the sets F and B were all the members in F or in B. $F \cup B$ = all the members of the class that played football or had blue eyes.

The members were listed on the chalkboard. Then several more examples were given using subsets of the class.

Attribute kits were then given to the children so they could demonstrate concretely the meaning of "union of sets". Several examples like the following were given:

$G = \{\text{all the green shapes}\}$

$T = \{\text{all the triangles}\}$

$G \cup T = \{\text{all the green shapes and all the triangles}\}$

During the lesson using the attribute kits the children were encouraged to express verbally what they had done after each example and to record their results using mathematical symbols.

This lesson required the children to express an abstract idea in concrete form and express this idea by means of verbal communication. They were encouraged to paraphrase the definition of "union of sets" and relate it to their own experience. The activities of this lesson are on the level of comprehension because they involve interpretation and translation as defined in this chapter.

Fourth Pair: Equivalent Sets - Activity VII (Involving Knowledge)

This lesson was introduced by presenting the children with the definition of "equivalent sets" as taken directly from "Modern School Mathematics Structure and Use", Duncan, Capps, Dolciani, Quast, Zweng, (1970). This text was using during the entire lesson.

Equivalent sets - Sets which are matched one-to-one and have the same cardinal number are equivalent.

Set A has 3 members. The cardinal number of A is 3. We write $n(A) = 3$. Each member of A is matched with one and only one member of B. A is matched one-to-one with B. $n(A) = n(B)$.

Several examples of equivalent sets were given by the teacher on the chalkboard. The children were taught to simply count the members of each set to determine if both sets had the same number of members. In this manner the pupils were taught to identify equivalent set.

The children were also introduced to the concept of equal sets.

Equal sets - Sets that have exactly the same elements.

Example of equal sets were provided by the teacher. The children were then assigned page 6 in the text. This exercise involved naming the cardinal number of the given sets and being able to pick out sets that are equivalent as well as sets that are equal.

The activities involved in this presentation were on the level of knowledge because repeated reference was made to the definition of equivalent sets and equal sets. The mechanical method of determining if two sets were equivalent was emphasized. The terminology used in this area of mathematics was made familiar to the children.

Activity VIII (Involving Comprehension)

This activity was presented by having the students consider the members of children in row 1 as set A. Then they were told to consider the children in row 2 as set B. They were asked if each member of A could be matched with one and only one member of B. Since the two sets could be matched in a one-to-one correspondence the students were taught that these were equivalent sets because they had the same cardinal

number of members. Several other examples using subsets of the class to demonstrate equivalent sets were given.

In the same manner the children were presented with the concept of equal sets, that is, sets that have exactly the same members.

Then the students were given attribute kits. One example of equivalent sets was provided and the children were required to match the members in a one-to-one correspondence. They were then taught to record their results. For example:

$B = \{\text{the set of all blue shapes}\}$

$G = \{\text{the set of all green shapes}\}$

$n(B) = 8$ and $n(G) = 8$ so $n(B) = n(G)$

The pupils were then told to name equivalent sets of their own, and to demonstrate the equivalence by setting them in a one-to-one correspondence. They were then encouraged to express their results verbally as well as to record them.

The activities of this lesson are on the level on comprehension because the children had to paraphrase the definitions. The students also were required to translate an abstract idea given verbally into a concrete form. They were also encouraged to relate the abstract idea to their own experience.

The sequence of presentation of each pair of activities was alternated for both groups of children. With K representing knowledge activities and C representing comprehension activities, this order was

followed in presenting the activities; the gifted group (K,C) (C,K) (K,C) (C,K); the heterogeneous group (C,K) (K,C) (C,K) (K,C). The alternating sequence of presentation was to determine if the order in which the activities were administered influenced the children's response to them.

The teacher that administered the activities to the gifted students was the regular sixth grade mathematics teacher for this program. This teacher was hired for this position following an extensive screening process by the school district. She has a master's degree in Elementary Education and 100 quarter hours in mathematics. This instructor has taught this subject on the high school, junior high and elementary levels.

The author of this paper administered the activities to the heterogeneous group. She has 30 quarter hours of mathematics and has taught this subject on the elementary and junior high school level. Presently, she is fulfilling the requirements for a master's degree in Elementary Education.

The two instructors planned each activity together to make the instruction of the two groups as equivalent as possible. The same materials were also used with both groups.

As the students completed each pair of the above activities they rated them on a scale from one to five. One indicated a less attractive activity and five a more attractive activity. A copy of the

instrument used in collecting the data can be found in Appendix II.

ORGANIZATION OF THE DATA

The responses of the students to the activities were organized in sets of ordered pairs and represented in tabular form. They were checked twice by two different teachers to insure accuracy of transfer. Tables of the children's responses can be found in Appendix III.

STATISTICAL HYPOTHESES

To assess the question: Are mathematical activities involving comprehension more attractive to gifted sixth grade students than mathematical activities involving knowledge? The following hypothesis was tested:

Among gifted sixth grade pupils there is no difference in preference for comprehension activities as compared to knowledge activities on selected math topics.

ANALYSIS OF THE DATA

The responses of both groups of children to each pair of activities was represented in tabular form. The statistical technique used to test the hypotheses was a two-tailed Wilcoxon matched-pairs, signed-ranks test for two correlated samples. This nonparametric statistic is used instead of the t-test because the t-test for the

significance of the difference between means assumes normality of the distribution of the variables in the population from which the samples are drawn. The t test also assumes that the data is in ratio or interval form. Since neither of these assumptions can be made regarding the data used in this study the Wilcoxon test was used as a satisfactory alternative to the t-test. This test gives more weight to a matched pair which shows a large difference between preference for one type of activity as compared to the other, than to a matched-pair which shows a smaller difference. The asymptotic relative efficiency of the Wilcoxon signed-rank test relative to the t test is .955.

The mean and standard deviation for the rankings of each type of activity was computed for both groups. Calculations were done on the computer at Montana State University. The computer program used was:

Statistical package: MSUSTAT

Program: NPPAIRED

SUMMARY

This study investigated which mathematical activities are more attractive to gifted sixth grade students; those activities involving comprehension of those activities involving knowledge as these terms are defined by Benjamin Bloom (1956). The data collected were the responses of 42 sixth graders identified to participate in

a gifted program in a large school district in Southwestern Montana. These students rated the two types of activities on a scale from 1 to 5 with one being the less attractive and five being the more attractive. The results were organized in ordered pairs and represented in tabular form. A Wilcoxon matched-pairs signed-ranks test for two correlated samples was used to test the hypotheses. The mean and standard deviation for each type of activity were also computed. The possibility that one of these two distinct groups of mathematical activities are more attractive to sixth grade students in a hetergeneous group was also investigated. The same procedures was followed for a heterogeneous group of children.

Chapter 4

ANALYSIS OF THE DATA

Data were collected to investigate whether gifted sixth grade children prefer comprehension activities rather than knowledge activities on selected math topics. The same type of data were collected from a heterogeneous group of sixth grade students to determine their preference for the same math activities.

Both groups of students rated four pairs of activities on a scale from 1 to 5 with one being the less attractive and 5 being the more attractive. Each pair contained one knowledge activity and one comprehension activity. The responses of the students were organized in ordered pairs and are presented in tabular form in Appendix III.

The Wilcoxon matched-pairs signed-ranks test was used in analyzing the data. This test can be considered a satisfactory alternative to the t test. The results of the Wilcoxon signed-ranked test are presented on the following tables.

Table 1 shows the Wilcoxon Matched-Pairs Signed-Ranks Test for the means of the responsed to all four of the knowledge activities as compared to the mean of the responses to all four of the comprehension activities for the gifted group. This test gives more weight to a matched-pair which shows a large difference in preference for one type of activity as compared to the other, than to a matched pair which shows a smaller difference. The statistic designates the probability

of arriving at the observed differences as a result of chance.

The standard deviation for the knowledge (k) activities as well as the standard deviation for the comprehension (C) activities are represented.

The total number of pairs N is shown. The N used varies from the total number of cases (37) because tied ranks were eliminated from the analysis as prescribed by the Wilcoxon test.

Table 1

Wilcoxon Test for the Mean of Knowledge Activities as Compared to Comprehension Activities for the Gifted Group

	N = 37
Knowledge Mean	3.142
Comprehension Mean	4.318
K Standard Deviation	.8691
C Standard Deviation	.5941
N Used	35
Sum of Rank + Differences	49.50
p signed rank	.0000

This test on all four pairs of activities was used to determine if there is significant difference in preference for comprehension activities as compared to knowledge activities on selected math topics among the gifted group.

Based on the analysis shown, the probability value is .0000.

Since the computed p is less than .05 significant difference has been demonstrated. The mean of the comprehension responses 4.318 is greater than the mean of the knowledge responses 3.142, therefore, a preference for comprehension activities as compared to knowledge activities on selected math topics has been demonstrated among this group of gifted sixth grade students.

Table 2 shows the Wilcoxon test for the mean of the responses to the knowledge activities as compared to the mean of the responses to the comprehension activities for the heterogeneous group. A standard deviation is also presented for each type of activity. The total number of student responses used, N, is shown. The statistic p designates the probability of arriving at the observed differences as a result of chance.

Table 2

Wilcoxon Test for the Mean of the Knowledge Activities as Compared to Comprehension Activities for the Heterogeneous Group

	N = 16
Knowledge Mean	3.984
Comprehension Mean	4.062
K Standard Deviation	.6612
C Standard Devition	.6651
N used	15
Sum of Rank Differences	56.00
p signed rank	.8424

This test on all four pairs of activities was used to determine if there is significant difference in preference for comprehension activities as compared to knowledge activities on selected math topics among the heterogeneous group.

Based on the analysis shown, the probability is .8424. Since the computed p is greater, the .05 differences, if they do exist, have not been demonstrated.

Table 3 shows the Wilcoxon test for each pair of activities as it was responded to by the gifted class. K represents the knowledge activities and C represents the comprehension activities. The mean and standard deviation were calculated on each of the eight activities. The total number of ordered pairs for each pair of activities N is shown. The N used varies from the total number (37) because tied ranks were eliminated from the analysis as prescribed by the Wilcoxon test. The statistic p designates the probability of arriving at the observed differences as a result of chance.

Table 3

Wilcoxon Test for Matched-Pairs of Activities for the Gifted Group

	N = 37							
Variables	K_1	C_1	K_2	C_2	K_3	C_3	K_4	C_4
Means	3.05	4.40	3.19	4.38	3.00	4.43	3.32	4.05
Standard Deviations	.911	.762	1.15	.76	1.25	.77	1.23	1.05
N Used	34		32		35		35	
Sum of rank differences	44.50		68.00		69.50		186.5	
p signed rank	.0000		.0000		.0000		.036	

This test was used to determine if there were significant differences in preference for comprehension activities as compared with knowledge activities on selected math topics among gifted sixth grade students.

Based on the analysis shown, the probability value for the first three paris of activities is .0000 and for the fourth pair is .036. Since the computed p in each of the cases is less than .05, significant differences have been demonstrated. The mean scores of the comprehension activities in all four ordered pairs is larged than the mean scores of knowledge activities. A preference for comprehension activities among the gifted sixth grade children has been demonstrated.

Table 4 shows the Wilcoxon test for each pair of activities as

it was responsed to by the heterogeneous class. The mean and standard deviation were calculated on each of the eight activities. The total number of ordered pairs for each pair of activities N is shown. The statistic p designates the signed rank value for each of the four groups of activities.

Table 4

Wilcoxon Test for Matched Pairs of Activities for the Heterogeneous Group

N = 16								
Variables	K_1	C_1	K_2	C_2	K_3	C_3	K_4	C_4
Means	4.12	4.19	3.94	3.50	3.44	4.44	4.44	4.13
Standard Deviations	1.26	.91	1.39	1.41	1.15	.63	.81	1.09
N Used	13		14		15		9	
Sum of rank differences	44.0		64.50		17.50		29.00	
p signed rank	.9443		.4703		.017		.4772	

This test was used to determine if there were significant differences in preference for comprehension activities as compared with knowledge activities on selected math topics among the heterogeneous sixth grade class.

Based on the analysis shown, the probability value for the first, second and fourth sets of activities are .9443, .4703, and .4772 respectively. Since the computed p is greater than .05, differences

if they do exist, have not been demonstrated. The third set of activities has a computed p value of .017. Since this p value is less than .05, differences in preference has been demonstrated in this case. In the third pair of activities the computed comprehension mean is 4.44. Since this is greater than the knowledge mean 3.44, it has been demonstrated that there is a preference for this particular activity as compared to the paired knowledge activity.

CONCLUSIONS

Based on the results of the Wilcoxon matched-pairs, signed-ranks test, the general questions as stated in Chapter 1 can be answered in the following way:

1. Do gifted sixth grade students have a preference for comprehension activities as compared to knowledge activities on selected math topics?

On the test of all four pairs of activities the mean score for the knowledge activities was 3.142 and for the comprehension was 4.318. The probability value was .0000, that is the possibility of these scores happening by chance is less than one out of 10,000. Therefore, it can be concluded that this group of gifted sixth grade students do have a preference for comprehension activities as compared to knowledge activities on selected math topics.

2. Do sixth grade students in a heterogeneous group have a

preference for comprehension activities as compared to knowledge activities on selected math topics?

On the test of all four pairs of activities the mean score for the knowledge activities was 3.984, and the comprehension activities was 4.062. The probability value was .8424, that is the possibility of these scores happening by chance is 84 out of 100. Since the chances are greater than 5 out of 100 it can not be concluded that this group of sixth grade students in a heterogeneous class have a preference for comprehension activities rather than knowledge activities on selected math topics.

SUMMARY

Data were collected and analyzed to determine if there was significant difference between gifted students preference for knowledge activities as compared to comprehension activities on selected math topics. The Wilcoxon matched-pairs signed-ranks test was computed to analyze the data. The analysis showed the probability value of .0000. Since the computed p was less, the .05 significant difference was demonstrated. A preference for mathematical activities involving comprehension rather than mathematical activities involving knowledge was shown among this group of gifted sixth grade students.

Data were collected in the same manner from a heterogeneously grouped sixth grade to determine their preference between the same

two categories on identical activities. The computed Wilcoxon matched-pairs signed-ranks test for this group showed a probability value of .8424. Since the computed p is greater than .05 differences, if they do exist, have not been demonstrated among this group of children.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The rapid development in our country of the concept of giftedness resulted in a change of attitude toward the education of precocious students. Recogniging the fact that the educational needs of these children are not being met by our system many new programs are being developed in their behalf. Educators and statesmen realize that society will greatly benefit if the potential of these special individuals is nurtured.

A review of the literature pertinent to this investigation includes the concept of giftedness, identification of gifted students, traditional educational provisions for gifted individuals and current approaches in curriculum to meet the needs of this group of children.

The concept of giftedness is as complex as the persons who possess it. Generally, it is divided into three major categories (1) superior ability in intelligence, (2) superior ability in creativity, (3) and superior ability in a variety of human talents. There are many kinds of giftedness to be cultivated and if a level is established on some single measure, we eliminated many extremely gifted individuals on other measures.

Professionally qualified persons such as teachers, administrators, school psychologists, counselors, curriculum specialists, artists, musicians and others with special training bear the responsibility of

identifying gifted youngsters for special programs. Each indicator used in the identification procedure has its shortcomings. In the most successful programs the persons responsible have decided what kinds of giftedness they want to nurture, selected the participants on this basis, and set about to develop the characteristics which have been used in selection.

The traditional curriculum provisions for the gifted are categorized under the headings enrichment, grouping and accelerations. Basically enrichment means adjusting instructions to meet the needs of each child. The controversy regarding it is whether it is more advantageous to provide enrichment in a heterogeneous class as opposed to a homogeneous class.

The research conclusions on homogeneous versus heterogeneous grouping are inconsistant with one another. Academic achievement in a homogeneous groups however, tends to be somewhat greater than in heterogeneous groups.

Even though available studies support the view that acceleration enhances academic achievement of the gifted it has been the least employed provision. Acceleration has been opposed on grounds that the students' social and emotional well-being may suffer from being placed with children who are chronologically older.

Sound educational opportunities can be available to gifted students under all three -- enrichment, grouping and acceleration.

Some new approaches that can be adapted for use under any of these three are: self-initiated learning; learning on one's own; the responsive environment; revised concepts of readiness; and search for self and one's uniqueness.

There have been major curriculum changes in the area of mathemathics. The nature of this subject matter lends itself to individualization of instruction so the gifted youngsters can master the abstract concepts as rapidly as his capabilities permits without being delayed in progress by the calculations of practical problems created for slower learners.

In the area of mathematics one of the basic educational objectives for gifted students is an improved understanding on their part of more abstract concepts and systems related to mathematics. A second objective is to help these talented children to realize that mathematics is a growing area with potential creative accomplishment. It is dependent upon the innovative ideas of gifted students, scientists and mathematicians to keep the field progressing.

Using Bloom's "Taxonomy of Educational Objectives", the California State Department in their Educational Objectives for teaching the Mentally Gifted suggested the following creative and cognitive abilities that should be developed with gifted students: 1. translation, 2. interpretation, 3. extrapolation, 4. application, 5. analysis, 6. synthesis and 7. evaluation.

This investigation was concerned primarily with the types of mathematical activities that are attractive to gifted students. Comparisons of knowledge activities and comprehensions activities according to Bloom's Taxonomy were made to determine if among gifted sixth grade students there is a preference for higher level math activities. The same activities were also presented to sixth graders in a heterogeneous group to determine if they have a preference for higher level math activities.

Data were collected from 42 sixth grade students identified to participate in a gifted program in a large school district in a particular city in southwestern Montana. This group rated four pairs of the two types of activities on a scale from 1 to 5 with one being the less attractive and five being the more attractive. The results were organized in ordered pairs and a Wilcoxon matched-pairs, signed-rank test for two correlated samples was used to test the hypothesis. The mean and standard deviation for each type of activity were also computed.

Data were also collected for a heterogeneous group of 19 sixth grade youngsters in the same school district and city in southwestern Montana. These pupils rated the identical math activities in the same manner as the gifted group to determine if sixth grade students in a heterogeneous class prefer higher level math activities. The Wilcoxon matched-pairs, signed-rank test for two correlated samples

was used to test the hypotheses. The mean and standard for each type of activity were computed for the heterogeneous group.

For the 42 gifted students the results of the Wilcoxon test showed the probability value of .0000. Since the computed p was less than .05 significant difference was demonstrated. A preference for mathematical activities involving comprehension rather than mathematical activities involving knowledge were shown among this group of children.

For the 19 sixth graders in the heterogeneous class the results of the Wilcoxon test showed the probability value of .8424. Since the computed p is greater than .05, differences if they do exist, have not been demonstrated among this group of children.

CONCLUSIONS

Based on the results of the Wilcoxon test the central questions asked in Chapter 1 could be answered as follows:

1. Do gifted sixth grade students in the gifted class have a preference for comprehension activities as compared to knowledge activities on selected math topics?

The mean score on all four pairs of knowledge activities was 3.142 and for all four comprehension activities was 4.318. The probability value for observing the scores by chance was .0000. Since this value is less than .05, it can be concluded that gifted sixth

grade students do prefer comprehension activities rather than knowledge activities on selected math topics.

2. Do sixth grade students in a heterogeneous group have a preference for comprehension activities as compared to knowledge activities on selected math topics?

The mean score on all four pairs of knowledge activities was 3.984 and for the comprehension activities was 4.062. On this comparison the value was .8424. Since this value was greater than .05, it cannot be concluded from this study that sixth grade students in a heterogeneous group prefer comprehension activities rather than knowledge activities on selected math topics.

RECOMMENDATIONS

In view of the above findings and conclusions the author made the following recommendations:

1. Since results from the Wilcoxon test supported the belief that gifted students prefer comprehension math activities rather than knowledge activities it was recommended to educators that the math curriculum for these youngsters include comprehension activities. The author believed that math activities on the levels of application, analysis, synthesis and evaluation should also be part of the curriculum for gifted sixth grade students.

2. It could not be concluded from the results of the second

Wilcoxon test that the sixth grade students in the heterogeneous group preferred comprehension activities rather than knowledge activities. This group of children were presented the activities during the weeks between Thanksgiving and Christmas. The distractions caused by programs, parties and festivities in anticipation of the holiday may have had a special influence upon these students' responses to the activities. Even though the data does not support the belief that this heterogeneous group preferred comprehension activities, this writer recommended that comprehension activities be included in the math curriculum for sixth grade students in a heterogeneous group.

3. It was recommended that this investigation be repeated at a time in the school year when there are fewer distractions than a major holiday.

4. No sampling procedure was used in this investigation. The gifted group consisted of the sixth grade students identified to participate in a gifted program in a particular city and school district in southwestern Montana. Further research was recommended with a sample taken from a larger group, such as all sixth grade students identified as gifted through the entire state.

5. The same recommendation as above was made in regard to the heterogeneous group. The group used in this study were all from the same area of the city and assigned to a classroom by a particular principal. A sampling procedure from a larger heterogeneous group

of sixth grade students was recommended.

6. The mathematical activities in this investigation were confined to set notation. The author recommended further research using activities involving different mathematical topics.

The investigator believed that the inclusion of mathematical activities on the higher levels of cognitive thinking according to Bloom's "Taxonomy of Educational Objectives" in a mathematics program will make this subject area more attractive to students. In conclusion the author intended this investigation to lead to knowledge that will be instrumental in curriculum improvements in the area of mathematics.

REFERENCES

REFERENCES

Bloom, Benjamin, editor
1956 Taxonomy of Educational Objectives Handbook I: Cognitive Domain. New York, David McKay, 201-207.

Duncan, Ernest R. Lelon R. Capps, Mary P. Dolciani, W. G. Quast, and Marilyn Zweng.
1970 Modern School Mathematics Structure and Use. Boston, Massachusetts: Houghton Mifflin Company.

Fox, Lynn H.
1975 "Facilitating educational development of mathematically precocious youth." The Journal of Special Education, 9:63-77.

Gallagher, James J.
1975 Teaching the Gifted Child. Boston, Massachusetts: Allyn and Bacon.

Getzels, J. W. and S. T. Dillon.
1976 "The Nature of Giftedness and the Education of the Gifted." Second Handbook of Research on Teaching, 689-703.

Getzels, J. W. and P. W. Jackson.
1958 "The meaning of giftedness - An examination of an expanding concept." Phi Delta Kappan (November) 75-77.

Guilford, J. F.
1956 "Structure of intellect." Psychological Bulletin, 53:267-93.

Hensley, Gene and others.
1971 "Questions and answers: The education of exceptional children. Report number 73." Education Commission of the States, Denver, Colorado.

Marland, S. P.
1971 "Education of the gifted and talented." Report to Congress of the United States by the U.S. Commissioner of Education. U.S. Government Printing Office, 1:1-61.

Pegnato, Carl W. and Jack W. Birch.
1959 "Locating gifted children in junior high schools: a comparison of methods." Exceptional Children, 25:300-04.

Pressey, S. L.
1954 "The most misunderstood concept acceleration." School and Society, 59-60.

Renzulli, Joseph S., Robert K. Hartman and Carolyn M. Callahan.
1971 "Teacher identification of superior students." Exceptional Children, 38:211-14.

Siegel, Sidney.
1956 Nonparametric Statistics for the Behavioral Sciences, New York: McGraw Hill.

Taylor, Calvin W.
1962 "Who are the exceptionally creative?" Exceptional Children 28:421-31.

Terman, L. M.
1954 "The discovery and encouragement of exceptional talent." American Psychologist, 9:221-30.

Torrence, Paul E.
1965 Gifted Children in the Classroom. New York: Macmillan.

Ward, V. S. (Chmn.)
1962 The Gifted Student: Manual for Program Improvement. Atlanta: Southern Regional Education Board.

APPENDIX I

DEFINITION OF KNOWLEDGE AND COMPREHENSION

APPENDIX I

DEFINITION OF KNOWLEDGE AND COMPREHENSION

Knowledge and comprehension, these terms are taken directly from Taxonomy of Educational Objectives; The Classification of Educational Goals; Handbook II; Cognitive Domain, edited by Benjamin S. Bloom.

Condensed version of the Taxonomy of Educational Objectives

Cognitive Domain

KNOWLEDGE

1.00 KNOWLEDGE

Knowledge, as defined here, involves the recall of specific and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting. For measurement purposes, the recall situation involves little more than brining to mind the appropriate material. Although some alteration of the material may be required, this is a relatively minor part of the task. The knowledge objectives emphasize most the psychological processes of remembering. The process of lreating is also involved in that a knowledge test situation requires the organization and reorganization of a problem such that it will furnish the appropriate signals and cues for the information and knowledge the individual possesses. To use an analogy, if one thinks of the mind as a file, the problem in a knowledge test situation is that of finding in the problem or task the appropriate signals, cues and clues which will most effectively bring out whatever knowledge is filed or stored.

1.10 KNOWLEDGE OF SPECIFICS

The recall of specific and isolable bits of information. The emphasis is on symbols with concrete referents. This material, which is at a very low level of abstraction, may be thought of as the elements from which more complex and abstract forms of

knowledge are built.

1.11 KNOWLEDGE OF TERMINOLOGY

Knowledge of the referents for specific symbols (verbal and non-verbal). This may include knowledge of the most generally accepted symbol referent, knowledge of the variety of symbols which may be used for a single referent, or knowledge of the referent most appropriate to a given use of a symbol.

1.22 KNOWLEDGE OF TRENDS AND SEQUENCES

Knowledge of the processes, directions, and movements of phenomena with respect to time.

*Understanding of the continuity and development of American culture as exemplified in American life.

*Knowledge of the basic trends underlying the development of public assistance programs.

1.23 KNOWLEDGE OF CLASSIFICATIONS AND CATEGORIES

Knowledge of the classes, sets, divisions and arrangements which are regarded as fundamental for a given subject field, purpose, argument, or problem.

*To recognize the area encompassed by various kinds of problems or materials.

*Becoming familiar with a range of types of literature.

1.24 KNOWLEDGE OF CRITERIA

Knowledge of the criteria by which facts, principles, opinions, and conduct are tested or judged.

*Familarity with criteria for judgment appropriate to the type of work and purpose for which it is read.

*Knowledge of criteria for the evaluation of recreational activities.

1.25 KNOWLEDGE OF METHODOLOGY

Knowledge of the methods of inquiry, techniques, and procedures employed in a particular subject field as well as those employed in investigating particular problems and phenomena. The emphasis here is on the individual's knowledge of the method rather than his ability to use the method.

*Knowledge of scientific methods for evaluating health concepts.

*The student shall know the methods of attach relevant to the kinds of problems of concern to the social sciences.

1.30 KNOWLEDGE OF THE UNIVERSALS AND ABSTRACTIONS IN A FIELD

Knowledge of the major schemes and patterns by which phenomena and ideas are organized. These are the large structures, theories, and generalizations which dominate a subject field or which are quite generally used in studying phenomena or solving problems. These are at the highest levels of abstraction and complexity.

1.31. KNOWLEDGE OF PRINCIPLES AND GENERALIZATIONS

Knowledge of particular abstractions which summarize observations of phenomena. These are the abstractions which are of value in explaining, describing, predicting, or in determining the most appropriate and relevant action or direction to be taken.

*Knowledge of the important principles by which our experience with biological phenomena is summarized.

*The recall of major generalizations about particular cultures.

1.32 KNOWLEDGE OF THEORIES AND STRUCTURES

Knowledge of the body of principles and generalizations together with their interrelations which present a clear, rounded, and systematic view of a complex phenomenon, problem or field. These are the most abstract formulations and they can be used to show the interrelation and organization of a great range of specifics.

*The recall of major theories about particular cultures.

*Knowledge of a relatively complete formulation of the theory of evolution.

INTELLECTUAL ABILITIES AND SKILLS

Abilities and skills refer to organized modes of operation and generalized techniques for dealing with materials and problems. The materials and problems may be of such a nature that little or no specialized and technical information is required. Such information as is required can be assumed to be part of the individual's general fund of knowledge. Other problems may require specialized and technical information at a rather high level such that specific knowledge and skill in dealing with the problem and the materials are required. The abilities and skills objectives emphasize the mental processes of organizing and reorganizing material to achieve a particular purpose. The materials may be given or remembered.

*To define technical terms by giving their attributes, properties, or relations.

*Familiarity with a large number of words in their common range of meanings.

1.12 KNOWLEDGE OF SPECIFIC FACTS

Knowledge of dates, events, persons, places, etc. This may include very precise and specific information such as the specific date or exact magnitude of a phenomenon. It may also include approximate or relative information such as an approximate time period or the general order of magnitude of a phenomenon.

*The recall of major facts about particular cultures.

*The possession of a minimum knowledge about the organisms studied in the laboratory.

1.20 KNOWLEDGE OF WAYS AND MEANS OF DEALING WITH SPECIFICS

Knowledge of the ways of organizing, studying, judging and criticizing. This includes the methods of inquiry, the chronological sequences, and the standards of judgment within a field as well as the patterns of organization through which the areas of the fields themselves are determined and internally organized. This knowledge is at an intermediate level of abstraction between specific knowledge on the one hand and knowledge of universals on the other. It does not so much demand the activity of the student in using the materials as it does a more passive awareness of their nature.

1.21 KNOWLEDGE OF CONVENTIONS

Knowledge of characteristic ways of treating and presenting ideas and phenomena. For purposes of communication and consistency, workers in a field employ usages, styles, practices, and forms which best suit their purposes and/or which appear to suit best the phenomena with which they deal. It should be recognized that although these forms and conventions are likely to be set up on arbitrary, accidental or authoritative bases, they are retained because of the general agreement or concurrence of individuals concerned with the subject, phenomena, or problem.

*Familiarity with the forms and conventions of the major types of works, e.g., verse, plays, scientific papers, etc.

*To make pupils conscious of correct form and usage in speech and writing.

2.00 COMPREHENSION

This represents the lowest level of understanding. It refers to a type of understanding or comprehension such that the individual knows what is being communicated and can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications.

2.10 TRANSLATION

Comprehension as evidenced by the care and accuracy with which the communication is paraphrased or rendered from one language

or form of communication to another. Translation is judged on the basis of faithfulness and accuracy, that is, on the extent to which the material in the original communication is preserved although the form of the communication has been altered.

*The ability to understand non-literal statements (metaphor, symbolism, irony, exaggeration).

*Skill in translating mathematical verbal material into symbolic statements and vice versa.

2.20 INTERPRETATION

The explanation or summarization of a communication. Whereas translation involves an objective part-for-part rendering of a communication, interpretation involves a reordering, rearrangement or a new view of the material.

*The ability to grasp the thought of the work as a whole at any desired level of generality.

*The ability to interpret various types of social data.

2.30 EXTRAPOLATION

The extension of trends or tendencies beyond the given date to determine implication, consequences, corollaries, effect, etc., which are in accordance with the conditions described in the original communication.

*The ability to deal with the conclusions of a work in terms of the immediate inference made from the explicit statements.

*Skill in predicting continuation of trends.

APPENDIX II

INSTRUMENT USED TO COLLECT DATA

APPENDIX II

INSTRUMENT USED TO COLLECT DATA

Evaluate your math activities for the past two days. Circle a number from 1 to 5 with 1 being liked least and 5 being liked best. Circle just one response.

ACTIVITY 1

1 2 3 4 5

Liked least Liked best

ACTIVITY 2

1 2 3 4 5

ACTIVITY 3

1 2 3 4 5

ACTIVITY 4

1 2 3 4 5

ACTIVITY 5

1 2 3 4 5

ACTIVITY 6

1 2 3 4 5

ACTIVITY 7

1 2 3 4 5

ACTIVITY 8

1 2 3 4 5

APPENDIX III

STUDENT RATINGS OF MATH ACTIVITIES

APPENDIX III

STUDENT RATINGS OF MATH ACTIVITIES

A represents the gifted group
B represents the heterogeneous group
K - Knowledge activities
C - Comprehension activities

A	No.	K	C	K	C	K	C	K	C
	1	3	5	5	5	5	4	1	5
	2	3	5	3	5	3	5	5	5
	3	3	4	3	4	4	5	4	5
	4	1	4	3	4	1	5	2	5
	5	3	5	4	4	3	4	3	4
	6	3	4	1	4	4	2	4	3
	7	4	3	4	3	3	4	3	4
	8	3	5	3	5	4	5	3	4
	9	4	5	5	4	5	4	5	3
	10	3	5	4	5	3	5	4	2
	11	3	5	4	5	1	5	3	5
	12	3	5	3	5	4	5	4	5
	13	4	3	5	2	4	5	5	3
	14	4	5	2	4	2	4	3	4
	15	4	2	3	3	3	4	5	1
	16	3	4	3	5	1	5	2	5
	17	2	4	3	4	3	4	3	3
	18	4	5	3	5	3	5	3	5
	19	3	4	4	5	4	5	5	4
	20	4	4	4	4	4	4	4	3
	21	5	5	4	5	5	5	5	4
	22	2	4	1	4	1	4	3	5
	23	3	5	4	5	3	5	3	5

	No.	K	C	K	C	K	C	K	C
	24	2	4	3	5	3	5	2	5
	25	3	4	2	5	3	4	4	3
	26	2	5	2	5	1	5	5	3
	27	1	5	4	5	4	2	3	4
	28	4	3	3	4	3	5	2	4
	29	2	5	2	4	2	4	1	4
	30	4	4	4	4	3	4	5	3
	31	3	5	1	5	1	5	2	5
	32	3	4	2	4	3	4	4	2
	33	3	5	3	5	3	5	2	5
	34	4	5	5	4	5	4	5	4
	35	2	5	2	5	1	4	2	5
	36	4	5	5	3	4	5	3	5
	37	2	5	2	5	2	5	2	5
B	No.	K	C	K	C	K	C	K	C
	50	3	5	1	4	4	5	4	4
	51	5	5	1	5	1	4	3	5
	52	5	4	4	4	3	5	3	4
	53	4	4	4	5	4	4	4	4
	54	5	4	4	3	4	5	5	5
	55	5	2	5	2	4	5	4	5
	56	4	5	4	5	5	4	5	3
	57	5	5	5	4	4	5	5	4
	58	1	5	5	2	1	4	5	1
	59	5	4	5	4	3	4	5	4
	60	5	4	4	3	4	5	5	5
	61	3	5	2	5	5	3	5	5
	62	2	4	5	3	3	5	5	5
	63	5	3	4	1	3	4	5	3

No.	K	C	K	C	K	C	K	C
64	5	3	5	1	3	4	3	4
65	4	5	5	5	4	5	5	5

(NOTE: Numbers refer to student identification numbers only.)