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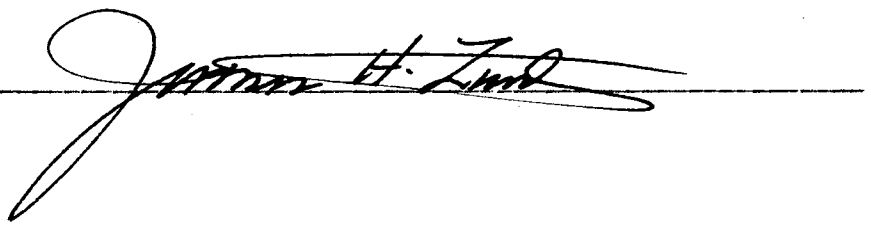
Scope of Study: To show that guidance into courses commeasurate with abilities is possible and can result in a saving of time and effort, greater accomplishment, and more benefits to student, instructor, and society.

Findings and Conclusions: My plan was to study guidance in the high school but my research showed me my study could not be limited to this level. It became evident that guidance, to be effective, should start in grade school. We, therefore, as mathematics teachers (along with many others, in our schools and communities) can and must do much to improve our offerings and subject matter to best fit the needs of the individual and society. Such guidance to be effective must start at the elementary level and to be adequate must have the co-operation and support of the mathematics teacher, the administration, and the community. Information is available or can be obtained that will permit determination by age 10 or 11 of the potential mathematicans.

ADVISER'S APPROVAL 

MATHEMATICAL GUIDANCE

By

MARY EVELYN ADAMS

Bachelor of Science

Oklahoma College for Women

Chickasha, Oklahoma

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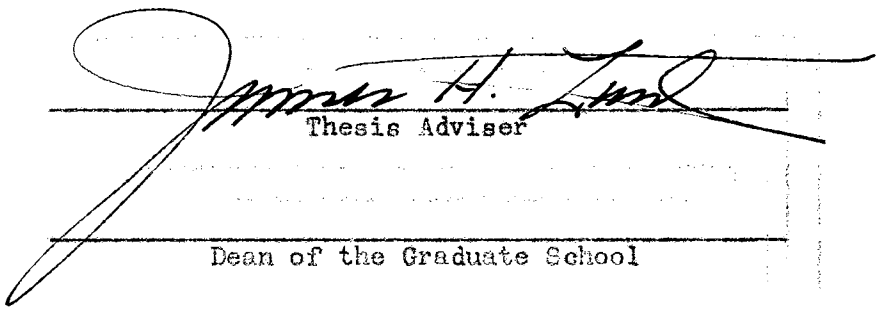

Thesis Adviser

Dean of the Graduate School

PREFACE

It was soon discovered, after research was started, that the problem "Guidance in High School Mathematics" could not be limited to high school. The authorities in both mathematics and guidance feel that we must find our potential mathematicans and start them on an accelerated program by age 10 or 11. For this reason, the study was broadened to include mathematical guidance at the levels and/or age groups where it is most benefical. The main difficulty was the separating of the mathematical guidance from scientic guidance in that most writings concerned both.

Acknouledgement is hereby given Dr. Zant for his suggestions and editing; the seminar group which made helpful suggestions; the office assistants of Dr. Zant who always were cheerful and understanding of the writer's problems; the assistance of Howard Chinn, Director of Guidance, Enid Public Schools; and Jane E. Hentz, Head of Mathematics Department, Tilden Technical High School, Chicago, Illinois. Indebtedness is acknowledged Ruth Maxine Bartlett, Woodward High School, for her time and effort in comments and suggestions that proved very benefical.

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CHAPTER I

INTRODUCTION

Premise: That adequate guidance at the proper level will best satisfy the student's need in his classroom work and society's needs in life.

That adequate guidance at the proper time will give every child a chance to work at his ability level and, therefore, achieve more.

That it is possible to forecast success and/or failure in mathematics.

That the prediction of this success can be made accurately as early as age ten or eleven.

That it is possible to guide students into mathematic courses all can profitably pursue.

That the mathematics teacher has a job of guidance as well as teaching.

Approach: Research--Library.

Personal interviews and correspondence.

The premises above are considered true by most of the authorities in these fields. The majority of the experiments and trails that have been carried on along this line also uphold these premises.

It is granted that all the ideas advanced herein are neither practicable nor practical in small schools with limited staffs and restricted curriculum offerings.

CHAPTER II

FUNDAMENTAL CONCEPTS OF GUIDANCE

"Guidance is the surest means we have found for avoiding costly, and sometimes tragic, guessing in dealing with young people."[1] Our experience with guidance and individaul instruction has convinced us that the critical bottleneck in a program of individualized education lies in teacher personnel. The problem of good teaching is in great part one of knowing how much guidance to give a student.

Good guidance gives direction--but only to the extent needed; permits freedom--leaving responsibility upon the student; and seeks understanding and meanings--not unreasoned responses. Over-guidance interfers with learning. Without guidance, learning in any organized sense, is impossible.

"Guidance, both as a part of all teaching and as a specialized function of special counselors, becomes the necessity of the century."[2] Assisting students in 'taking the next step', whether it be a job, an

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[1]Benjamin De Kalbe Wood and Ralph Haefner, Measuring and Guiding Individual Growth (Chicago, 1948), p. 435.

[2]Paul Street, "Guidance: The Century's Educational Necessity," Personnel and Guidance Journal, XXV (1957), 462.

extra-curricular activity, or a mathematics class, is the responsibility of the guidance program. The test of effective guidance is the degree to which it has facilitated the learning of each pupil. "Guidance is a special concept of the teaching process which requires a specific point of view."[3]

No curriculum is appropriate for all children at the same instant; therefore, learning must be an individual matter. What is taught in the curriculum, at all levels, has a significant influence on a student's vocational orientation. The teacher serves an important guidance function when he creates opportunity for the discovery and nurture of the special talents of his students.

America has a misconception that 'freedom of education' implies that the same education is good for all, regardless of abilities or interest.

> Giving encouragement is important, but it should be given to 'the right individuals at the right time' and directed towards achievement of the right goals for these individuals. Little is gained by trying to encourage the wrong individuals to do something which, for them, is 'impossible'.[4]

Trained counselors with teaching experience are in short supply. Often times regular teachers must be hired to do the counseling. This practice needs study--it would probably be better to have the trained counselor with no teaching experience than the teacher with no training in counseling. The teacher, whether a trainod counselor is available or

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[3]Roy DeVerl Willey, Guidance in Elementary Education (New York, 1952), p. 35.

[4]Theodore S. Cooper, "The Technical Manpower Shortage--an Answer from the High School," Mathematics Teacher, IL (1956), 437.

not, is and should be, a great influence on those she teaches. Guidance is a function of all who educate.

Guidance is the assisting of young men and women to learn 'to stand on their own two feet' and plan their own futures as far as possible. The student should consider his interests, become acquainted with his aptitudes and capacities, and learn the career opportunities available to majors in a particular area of specialization. It is partly the teacher's job to see these facts are available and help the student find out about himself.

> Guidance and a better articulation between high school and college courses are desirable as a means of reducing the hurdles which now tend to discourage capable youngsters from going on with their college education.[5]

One out of five youngsters in the top scholastic fourth never finish high school. One half of our children who are endowed with the ability to enter college and university do not do so. Thirty percent of our total high school graduates go to college but only forty percent of our brightest boys and girls, those who rank in the top fourth in intelligence, go. Fewer than half of the top fourth of the high school graduates in the United States earn college degrees; six out of ten of the top five percent earn degrees. For every high school graduate who eventually earns a doctoral degree there are 25 others who have the mental capacity to achieve that degree, but do not.

The gifted child has been the neglected child because he is usually able to learn under unusual handicaps. With few exceptions, few

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[5]"Facts for Thoughtful Teachers," Mathematics Teacher, XLVIII (1955), 17.

of the 15% to 20% (classified 'talented', IQ of 115 or more--10% of those 'brilliant', 135 IQ or over) are being taught any different than any of the other students in our schools. We are teaching 70% of the 14-17 year olds--we can not afford to 'lose' the potentials among them.

Individual counseling should start in the grades and ideally should include the parents. Nancy C. Wimmer,[6] speaking of 8 to 10 year olds, says the attitudes and examples of their parents and teachers, as well as the thinking and planning that their parents are doing today, may well determine whether or not college is a possibility for these youngsters and will become a reality.

The recommendation made most often, as a proposed partial solution, is the three tract program: 1. Professional work. 2. Skilled trades. 3. Unskilled work. This would allow those with ability to go ahead. The choice would be left, to some extent, to the student, since motivation would be a key factor.

Altho' our 'talented' are important to us in the complex world we live in, they are not the only ones who will benefit. Certainly it will be an advantage to the average group and even to the lower IQ students to be placed in groups where they will be challenged to achieve to the limit of their ability; and be given courses from which they will benefit, rather than courses they can not comprehend and probably will never use.

"In our population of students we have enough academic potential to satisfy all the demands of the future for educated citizens in every

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[6] Nancy C. Wimmer, "College: A Grade-School Decision," National Parent Teacher, September, 1957, p. 26.

field, but we must appropriately develop that potential."[7] The variance in the abilities of students to profit from any given program of studies is well known. When we insist that teachers consider individual differences, we must provide all possible assistance in identifying those differences and in building an adjustable curriculum.

Students with a high probability of success in college can be identified by grade three. It is at this time, that a three track program is proposed. Before this, it is probably not possible with any great degree of accuracy, nor even advantageous.

In the secondary school, one of the primary functions of the guidance program is to help the student and his parents plan for an educational program--vocational or academic--that will adequately prepare the student for occupational fields at a level commensurate with his potentialities. The value and success of guidance will depend heavily on the curriculum offerings of the school. Guidance alone is not the answer to our problem--we must have an adequate curriculum to satisfy the needs of the students after their abilities are determined.

Administrators, rather than go against the wishes of a few, may refuse to allow the three track system in their school; and yet, this is the system whereby the majority of the students will benefit. There should be no disgrace attached to the placement of a child--he should be where his ability can best be used and where he can compete with others of his own intelligence. Where the student will benefit the most should

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[7]Frank E. Wellman, "Guidance and the Curriculum," School Life, April, 1958, p. 5.

be where we, as interested adults, should want and put him. It must be kept in mind that students can be moved up or down, depending upon his observed performance, after he has been placed in a group. The curriculum must be set up so no harmful effects will accrue from a child's changing from one track to another.

Mental intelligence can now be predetermined for in individual placement in a three track program so the administration and public, as well as some teachers, must realize this is the only way a student can be assured an education matching his ability and one assuring full benefit to him and society. The guidance people are ready, they can identify ability of students.* (If IQ tests are used for grouping, at least three are recommended. One may under-rate his IQ but it is doubtful he will over-rate it.) It is possible a student may be in one group in certain subjects and in another in other subjects. It is the teachers' job to see that those that are not classified correctly are changed, for the student must be where he will be challenged and, yet, where he is able to achieve.

In nearly all fields of science (mathematics being classified a science), the best work is done between 25 and 35, and rarely later than 40. The youth of high achievement potential should be well trained for his life work before too many of his creative years have passed.

> The exceptionally bright student who is kept with his age group finds little to challenge his intelligence and all too

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*Refer to Case D in Chapter IV.

> often develops habits of laziness that later wreck his college career.[8]

It is not proposed that a student be taken completely out of his age group--he should be allowed to stay in the same school with those his age but in a class with his own ability until he finishes high school.

> In the final analysis, our social organization, in terms of its economic, political, and technological factors, determines the necessary education of any individual preparing to play a role in society.[9]

The social development brought about by proper association is essential.

The Joint Committee on Atomic Energy (1958)[10] recommends: A stronger program for identifying the ablest students in our high schools at an early age and presenting them with challenging courses to stimulate their minds. They also recommend a state wide testing in 8th or 9th grade to find the ablest students. According to most authorities this is too late a date to start looking for talent; the 3rd or 4th grade would be better.

We fail to identify and develop our talented children early enough, if at all; and most schools are probably not equipped to do justice to the special needs of such pupils. The slowest group generally sets the pace and therefore receive most of the teacher's attention. This tends towards lack of interest, sloppy habits, and a false sense of superiority

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[8] Lewis M. Terman, The Discovery and Encouragement of Exceptional Talent, World Book Company Test Service Notebook No. 14 (Dallas), p. 2.

[9] Clyde E. Parrish, "Junior High School Mathematics and the Manpower Shortage," Mathematics Teacher, IL (1956), 611.

[10] "Can We Continue to Ignore these Warnings," Mathematics Teacher, LI (1958), 242.

among the 'talented'. We must learn to think of the 'exceptional' child as the 'talented' not the 'handicapped'. "We shall not do justice to our talented children or to the future of our country unless we seek them out at an early age--no later than 10 or 11--and educate them separately."[11]

Test scores and school marks together predict more accurately than either one separately. Test results do not give perfect records but the percentage will be high as to prediction.

> . . . . . tests are by no means infallible but they provide a highly serviceable degree of accuracy. Properly understood and properly used, tests offer a potent aid in the selection, guidance, or placement of students.[12]

Test scores must not be a hard and fast rule; teacher opinion, accumulative records, personality--all are necessary parts of the complete picture.

A student found to be in any one of the three proposed tracks at any age level must not be condemned there for his 12 years of schooling; nor must he be forced to stay in that track for all subjects. It is a fact that an individual's talents may place him 'average' in one subject and 'outstanding' in another and that his talents and/or interest can increase (or decrease) enough to bring him into another track--at least in certain areas.

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[11]Rear Admiral H. G. Rickover, USN, "Let's Stop Wasting our Greatest Resource," Saturday Evening Post, March 2, 1957, p. 111.

[12]Henry Chauncey, "How Tests Help Us Identify the Academically Talented," NEA Journal, XLVII (1958), 231.

Accomplishment of many of the comparisons listed below has now taken place in our modern system of education. Yet much improvement can be made by enlightened, educated parents and public and by enlightened teachers and administration.

Forcing the student	to	Helping the student
Rote memorizing		Trying to get meaning
Formal reading, writing, and speaking		Communications for understanding
Learning as getting predetermined information		Learning as exploring for the answers to problems
Learning as bitter medicine to be taken by the student		Learning as growing through experience
Drill for drill's sake		Some drill, but with a purpose
Subject matter as inviolably searced		Childhood as sacred
Every child treated alike		Respect for individual difference
Courses inherited from an aristocratic tradition		Courses based upon like needs in a democratic society
Concern for the intellectual only		Concern for all aspects of the child's growth
Absolute facts and 'right' answers		Relative values and best answers possible
Unquestioning obedience		Reasons for conformity
The teacher is omniscient		The teacher as a guide who has 'been there before'.[13]

> A child who does what is expected of him wins his teacher's approval, whereas the child who is independent in his thought or behavior or asks embrassing questions may antagonize his teachers; yet, originality and curiosity are characteristics of superior intelligence.[14]

Teachers may err in their judgments by confusing school achievement

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[13] Op. cit., Personnel and Guidance Journal, p. 460.

[14] Identification of the Gifted, World Book Company Test Service Notebook No. 7 (Dallas), p. 1.

with intelligence. The material for guidance lies in the individual and his capacities as much as in the economic sense, and the objectives of guidance lie in the individual's welfare and growth, even when the interests of manpower needs are considered.

Guidance is not the work of a few specialitists. It is, rather, a responsibility of the entire school staff, which requires some people with special knowledge and skills, but enlists the co-operation of all.

> To provide appropriate educational opportunities for every child is not only the answer to the great challenge of our times; it is the fulfillment of a solemn obligation upon which rests the survival of the free world.[15]

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[15] Op. Cit., School Life, p. 6.

CHAPTER III

APPLICATION OF CONCEPTS TO MATHEMATICS

A survey at the University of California, Los Angeles, has shown that most parents tend to discourage youngsters, especially girls, who show a first, hesitant mathematical interest in high school. The dislike by parents probably came from depression days when mathematics was thought to be an economic dead-end street. It was considered practical for teaching and, possibly, life-insurance careers, but useless to industry. This idea must be overcome by this generation of parents now on the way up.

If we are to meet the challenge of the post-sputnik age, Dr. Magnus R. Hestenes, chairman of the UCLA Department of Mathematics, believes we must show that mathematics is not only 'respectable' but 'essential' to the nation's education, economic, and scientific development.

While our high school graduates are under criticism for arithmetic deficiencies, there is parental pressure for pupils to choose algebra and geometry rather than general mathematics. While the choice at the end of the 8th grade should be based on aptitude and vocational needs, sufficient program flexibility is required to allow for change of plans without penalizing the pupil. The administration and teachers must make available a new program of mathematics (more than one track).

We must have (a) an early discovery of technical competence, through arithmetic achievement, intelligence and aptitude tests, and try out units in algebra and geometry, (b) an exploration and discussion of the uses of mathematics in various vocations, leading to a consideration of the nature and purpose of the several sequences in mathematics in the secondary school, (c) a public relations program designed to secure the understanding and co-operation of the parents, supported by the administration. The multi-track program of mathematics must have (a) a challenging and interesting sequence in mathematics for education, (b) a pretechnical four year sequence, in which standards can be maintained suitable for selection and preparation of technical leaders, (c) a sequence including algebra and geometry for the student headed for a non-technical college program.[16]

The nature of the mathematics curriculum, past and present, is directly related to the lack of awareness and the lack of appreciation that the general public feels in regard to mathematics. Those who were going into neither college nor industry; or, if going to college, did not intend to pursue a specialized line, are the ones who suffered most from our mathematical diet in pre-war times. We either let them starve completely or we gave them acute, mental indigestion by feeding them the wrong mathematics diet. A course in Business Mathematics and related mathematics has already done much to brighten up our gloomy mathematics picture that existed in pre-war days. This course must sell itself to the student because of the practical application they can readily see.

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[16] Truscott, Jenkins, and Korb, "Who Teaches Algebra to Whom?" Mathematics Teacher, XLVIII (1955), 260.

Not only must we make the problem situation vital in the 2nd and 3rd tracks, but we must exploit such situations to the fullest degree in obtaining for the pupil a maximum of worthwhile educational experiences--not overlooking concept and understanding. It will, then, be our job to remove all stigma so every student may feel at ease (socially) taking the course that will best fit his needs. It is a known fact that a high school course in general mathematics has been given a bad name. Much orientation will have to be done with administration, guidance counselors, and parents to acquaint them with the objectives and content of such a course. In many cases, time will have to be allowed teachers so they can prepare syllabi and content material for classes when suitable texts are not available.

As far back as 1941 many were already proposing, as an aim of our curriculum, 'the right kind of mathematics for everybody'--adjusting the offerings of the department to the different levels of ability and preparation occuring among high school students and to the many uses for mathematics in present-day living. This method is an accepted policy at Tilden Technical High School, Chicago.* In 1957, in Oklahoma, there were 25% more enrolled in algebra and plane geometry than in the previous year. The Frontiers of Science Foundation drive found students, whose parents and teachers thought dull, with marked scientic ability; they were not dull--just bored! The same organization is offering jobs to students and teachers to let them sample job requirements and decide what essentials should be taught and learned for practical use.

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*Refer to Case B in Chapter IV.

A report* of enrollment in algebra and geometry at Manual High School, Denver from 1954-56 shows an increase as evidence of our demand for more mathematicans. The report indicated that not only does most of the added enrollment fail but it probably takes with it part of the original number of potential passing students.

General mathematics must be offered for those who have not yet mastered fundamentals. "Watering down" our course in algebra to prevent failures is not a solution to the problem.

The first report of the Commission on Post-war Plans says we should differentiate on the basis of needs, without stigmatizing any group, and should provide new and better courses for a high precentage of the school's population whose mathematics needs are not weel met in the traditional sequential course; the school should insure mathematics literacy to all who can possibly achieve it, and the sequential course should be greatly improved. The second report of the same commission emphasized that the school must provide sound mathematical training for our future leaders in mathematics and other fields and, also, insure mathematical competence for the ordinary affairs of life.

A guidance counselor can help and suggest, but the final choice of a course of study is the direct responsibility of the pupil and his parents, the mathematics teacher and the school administrator. The information acquired about the role of mathematics in contemporary society and, in particular, in the future vocations of his students should provide the teacher with an important means of motivating the study of mathematics.

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*Refer to Case C in Chapter IV.

Frank McClure, executive in the personnel Department of the Radio Corporation of America, says "one of the reasons we urge every youth--boy or girl--to take mathematics and science is because it requires careful thinking and helps develop accuracy."[17] He further states that there are many opportunities for girls who have specialized training in mathematics.

The mathematics teacher is considered as having by far the greatest influence on stimulating interest in mathematics. The heart of the solution, therefore, lies in the development of a corps of well-trained, enthusiastic, stimulating, and diligent teachers of mathematics. An environment that produces high morale and adequate financial rewards will be necessary to attract and hold such teachers in the profession.

The talented must be found early. By high school age, it may be too late. We can not plan to guide our students into proper mathematics courses in high school unless proper guidance has taken place in grade school. Trials are being made to find the talented by grade one but the majority feel any attempt to seperate for a three track program should not be initiated at this early age. However, separation definitely should be done by age ten or eleven for most effective results.

Even those who are most sensitive to our needs for trained talent in fields other than mathematics join in urging the schools to increase their efforts toward early identification of the gifted and specially talented, to the end that such youths may be enabled to develop their talents to the full, in their own, as well as the nation's, interest.

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[17]William Favel, "Charting your Road Ahead for the Business World," Senior Scholastic, February 22, 1957, p. 24.

There is a temptation to feel that the early identification of students of promise in the fields of mathematics calls for unusual measures, such as specially devised tests or extensive testing programs over and above those in common use in schools.

> Talent in mathematics can be found in the junior high simply through full utilization of the kind of information about pupils that emerges from any good testing program and from careful observation on the part of the teacher.[18]

Portents of later successful careers in mathematics are often apparent even as early as age ten or eleven.

Several key characteristics are signposts pointing out probable mathematicians: 1. An IQ of 110 or above, ranking in the upper fourth of his age or grade group. 2. Extensive reading at a more mature level than his classmates. 3. Breadth of vocabulary. 4. High level of learning in arithmetic--early evidences of interest in the quantitiative aspects of the environment; the number system, calendars, clocks, thermometers, and the like, seem particularly important clues to future success in mathematics. 5. Frequently has great breadth and depth of knowledge of a particular area of general field of science. 6. Inquiring and curious about the world around him--shows unusual signs of originality and inventiveness in his thinking. 7. Interest in mathematics or in various branches of physical or natural science at junior high level.

This is not to say that weaknesses in certain of these areas could not be corrected even after junior high level. The test data, plus what the teacher has observed about the student's interest, and study habits,

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[18] Finding Mathematics and Science Talent in the Junior High School, World Book Company (Dallas), p. 1.

give solid basis for regarding him as or as not potential for success in mathematics. The search for mathematic talent will be most effectively conducted if it is treated as one phase of a comprehensive program for discovery and development of all the talents of all youth.

Charlotte Junge[19] says the characteristics of gited children are: 1. High verbal comprehension. 2. Superior vocabulary. 3. Intellectual curiosity and imagination. 4. Ability to assimilate and generalize. 5. Capacity for objective self-analysis. 6. Persistence. 7. Insight. Along with the characteristics given above, the bright child in arithmetic evidences alertness and curiosity that lead him to search out facts for himself, to set arithmetical tasks for himself, and to be aware of the quantitiative aspects in his home and school environment. He shows interest in investigating topics in encyclopedias and general reference books; he brings in problems found in newspapers and magazines and makes up problems from data in science and social studies. He thoroughly enjoys working with numbers and is confident and self-reliant. He is a 'continuous learner', ready to extend his present learning into new fields.

To determine these 'special children' we must use all the time-tested ways. Standard tests of intelligence and achievement should be employed; informal teacher-made tests and inventories should be part of the identification procedure; nothing can replace the careful, clinical observation of good teachers as they work with children day by day. The

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[19]Charlotte Junge, "The Gifted Ones--How Shall We know Them?" Arithmetic Teacher, IV (1957), 142.

search must begin early--kindergarten and first grade is not too soon, for many children come to school with a well-developed interest in numbers and an amazingly good grasp of some number concepts.

Today, education is being challenged to develop leadership for the tremendous tasks that lie ahead. Under such conditions special attention to the gifted in our schools is both justified and demanded and plans must be made for initiating an enriched program to challenge the abilities of these children. If there is no guidance available, then, as teachers of mathematics, this must be our job for those interested and having ability in the mathematic field. Our prime interest must be the greatest service to the student.

> . . . . counseling in secondary mathematics should be based on the mathematical ability of the student rather than on his intentions of the moment with respect to a future vocation, or future collegiate training.[20]

"Some pupils fail courses in mathematics because they were guided into courses without proper consideration of their previous experience in mathematics."[21] Few pupils work at their maximum capacity or realize their full potential in mathematics. Pupil failure may be decreased under intelligent guidance. For effective guidance, the full support of the administration is desirable and, possibly, necessary--although we realize the primary task of guidance lies with the classroom teacher. The greatest single factor in influencing the pupil is the personal contact.

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[20]William L. Hart, "Suggestions for Counseling in High School Mathematics," Mathematics Teacher, XLVIII (1955), 176.

[21]Kenneth E. Brown, "The Mathematic Teacher's Opportunities for Guidance," Mathematics Teacher, XLVII (1954), 311.

The choice of a life work is almost never made all at once, nor made in a short space of time. It is, therefore, necessary that we work with potential mathematicans at all times--not over certain years or periods of time.

> There is a very great need for a reliable prediction of a pupil's success in algebra. The ever-increasing number of student's entering the high school has presented the problem of best placing the student in work which he is capable of doing. A means is desired whereby students who are not capable of doing the work of a course are discovered and placed where they can succeed.[22]

At the high school level, even though first year algebra has been taken, the identification of students weak in fundamentals of arithmetic would materially reduce later failures and better prepare able students for high-level work.

> Five courses of action are suggested: 1. More comprehensive educational and vocational guidance programs, staffed with trained guidance counselors, and an adequate testing service to identify the most able students. 2. Homogenous grouping of students with special interest in, and aptitudes for, science and mathematics, in special classes and special science high schools. 3. Effective guidance in the area of scientific careers for girls. 4. A minimum of 3 years of science and 3 years of mathematics for all college preparatory students. 5. A corps of 'well-trained, high professional and intersated teachers of science and mathematics', with higher status and pay.[23]

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[22]Murray Lee, Manual of Directions for Lee Test of Algebraic Ability, Public School Publishing Company (Bloomington), p. 3.

[23]"New York City Schools Meet Challenge," Mathematics Teacher, LI (1958), 462.

CHAPTER IV

CASES

It is not possible to present here all the examples and cases studied but an effort has been made to accurately summarize the facts found by submitting outstanding and typical samples; it is the desire of the writer for you to have here a few examples that appear to her the most outstanding cases.

Only two studies (and those did not agree with each other) were found that did not uphold the information presented heretofore. One study by John R. Hills, Educational Testing Service, Princeton, N. J., states that the finding of a potential mathematican would be difficult if not impossible. He feels that there is no adequate test and/or method to determine them since there is no one trait we can find which makes a future mathematican. The other study, by M. M. Ahrendt, Executive Secretary of the National Council of Teachers of Mathematics, reports that our most talented do take mathematics along with the hard courses offered in our high schools. His study is based on 620 winners of the Annual National Honor Society Program, 1956.

These two negative studies are far out numbered by positive studies, reports, opinions, etc. that were found in my research. Mathematicans and guidance personnel generally are convinced and state positively

that there is much we can do in locating and developing mathematical talent to benefit both the individual and society.

Case A. In two similar schools in Kansas (150 students; grades 7-12; equivalent in other aspects) it was found that in the one employing a trained counselor on duty 15 hours a week the students, as a group (after only one year), were superior in personality adjustment, in academic achievement, in achieving more nearly at their level of abilities and in making suitable choices of vocations. Each senior had made a choice of vocation and 68% of these choices were consistent with abilities. In the other school, where no counselor was available, only 25% of the seniors had made suitable vocational choices and 64% had made no choice at all.

Case B. At Tilden Technical High School (a pre-engineering school, requiring algebra, geometry, physics, and chemistry for graduation), Chicago, a test is given and those ready for algebra are enrolled; those not ready are assigned a course called Special Mathematics I. If classroom work shows a change is necessary, it can be made--test scores are not a hard, fast rule. The mathematics track prepares students for algebra at a later date. It takes up many of the same topics at slower pace and after arithmetic background work.

Case C. In 1954 at Manual High School, Denver, Colorado, 200 (37%) of 535 students were in algebra or geometry courses; 20 (10%) failed. In 1955, 218 (60%) of 362 students were in algebra or geometry courses; 76 (35%) failed. In 1956, 321 (53%) of 645

students were in algebra or geometry courses; 145 (45%) failed. The net number passing was 180, 142, and 176 in the years 1954, 1955, 1956 respectively. Not only did most of the added enrollment fail but it probably took with it part of the original number of potential passing students.

Case D. Out of 540 placed on a three track program in one of Oklahoma's prominent junior high schools in 1958, only 4 were found to have been placed wrong and these mis-placings were found before the 2nd semester end correction made.

Case E. Finalists in Comprehensive Mathematics, a section of the Indiana State High School Achievement program (125 per year studied, 1952-1955) gave the following information on questionaires: The mathematics teacher is ranked as having by far the greatest influence on stimulating interest in mathematics. The teacher also ranked high in influence on going to college. Teachers and new publications are largely responsible for superior students being aware of the current shortage of mathematicians. A very high percent of superior high school mathematics students attend college. An average time for this superior group to make this decision is the 14th year. The high school teacher has paramount influence on the development of interest among superior students in the fields of mathematics. The high school teacher also has greatest influence on the choice of college major made by superior mathematics students under his guidance. The most appealing facets of

scientific work are the mental stimulation, the challenge of the unknown, and the creative opportunities offered. The attack, therefore, on the problem of mathematics manpower shortages focuses on the secondary school teachers of mathematics.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

Conclusion: My problem was to show the role of guidance in mathematics. The plan was to study guidance in the high school but my research soon showed me my study could not be limited to this group. It became evident that guidance, to be effective, should start in grade school. My findings support the premises made. We, therefore, as mathematic teachers (along with many others, in our schools and communities) can and must do much to improve our offerings and subject matter to best fit the needs of the individual and society.

Recommendations: That a three track program of mathematics would best fit our current educational needs. (The writer grants that this would be difficult, if not impossible, for the small school.)

That the curriculum be so organized that there will be mathematic classes beneficial to all individuals.

That guidance start in the grades so the talented student will not become bored but will be challenged at his level of thinking.

That it be decided when students are ready for the traditional sequence (by proper counseling, testing, and individual desires) and that no attempt be made to force it on them beforehand or waste the time of the 'talented' with other work.

That, from a student's ability, it be decided what is best for him and that he be guided into the most suitable track.

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VITA

Mary Evelyn Adams

Candidate for the Degree of

Master of Science

Report: MATHEMATICAL GUIDANCE

Major Field: Natural Science

Biographical:

Personal Data: Born at Maud, Oklahoma (Pottawatomie County), February 20, 1932, the daughter of Elmer E. and Mildred Adams.

Education: Attended grade school at Central Ward, Maud, Oklahoma. Graduated from Maud High School in 1950; received the Bachelor of Science degree in Business Education from Oklahoma College for Women, Chickasha, Oklahoma, after attendance there and at East Central State College, Ada, Oklahoma; did graduate work, by extension, from Oklahoma State University and by attendance at Colorado University; completed requirements for the Master of Science degree in May, 1959, at Oklahoma State University as a member of the National Science Foundation Institute.

Professional experience: Taught high school and seventh grade mathematics at Woodward, Oklahoma from 1953-55; taught high school mathematics--one year, at College High School, Bartlesville, Oklahoma, and two years at Enid High School. I am now on leave of absence from Enid High School to attend the Oklahoma State University National Science Foundation Institute. While teaching I am a member of NEA, OEA, Okla. Council of Teachers of Mathematics, Business and Professional Women, and the local education association. I have been chosen as a member of the two honorary societies: Pi Zeta Kappa and Pi Mu Epsilon. I belong to Order of the Eastern Star, First Methodist Church, Kappa Kappa Iota, and National Council of Teachers of Mathematics.