Predictor Variables Discriminating with Success or Failure of Handicapped Students on the Retest of the Maryland Functional Mathematics Test.

by

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(Abstract)

The purpose of this study was to determine which pupil and program characteristics discriminate with the success of learning disabled and mildly mentally retarded students on the retest of the Maryland Functional Mathematics Test (MFMT). A secondary purpose was to provide Baltimore County Public Schools (BCPS) with added knowledge to utilize in planning for handicapped students' Individualized Educational Program (IEP). The sample consisted of 270 handicapped ninth grade students who failed the MFMT in the fall of 1985 and took the retest in the spring of 1986. Students taking the retest were divided into those who passed and those who failed. Data were collected describing the pupil's general ability, mathematics ability, race, sex, age, attendance, handicapping condition, level of special education services received, mathematics grade, and type of appropriate assistance received. Data were analyzed by employing a step-wise discriminant analysis. It was concluded that general ability, handicapping condition, sex, mathematics ability, mathematics

grade, and race when in conjunction with each other discriminated with success on the retest of the MFMT. A model for utilizing the information in decision making was offered for school systems determining on an individual basis whether handicapped students will work toward a regular diploma or Certificate of Attendance.

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CHAPTER 1

Minimum Competency Tests (MCT's) are increasingly being used throughout the country as a means of accountability in public schools. In almost one-half of the states, the tests are used to determine whether a student will graduate from high school with a regular diploma. The handicapped student when included in the testing finds it one more hurdle to be jumped in order to receive a regular high school diploma. This study looks at a specific MCT being administered to learning disabled and mentally retarded students as one part of their graduation requirements in Baltimore County Public Schools, Maryland.

Minimum Competency Testing in Maryland

There are four MCT's presently being given in Maryland, all of which must be passed in order to receive a regular diploma. Maryland educational bylaws established that the passage of these competency tests would be a requirement for graduation. (Code of Maryland Regulations COMAR 13.03.01.04) State Superintendent David Hornbeck had originally requested that six minimum competency tests be required for graduation in Maryland: Reading, Writing, Mathematics, Citizenship, Leisure, and Work. Through the Office of Project Basic (Project Basic), the Maryland State Department of Education (MSDE) established objectives for the

areas of basic and life skills. The Maryland bylaws required that each school system in Maryland assure that the Project Basic objectives are taught and that all students have an opportunity to achieve them. The four MCT's which ultimately became part of the requirements to graduate include Reading, Mathematics, Writing, and Citizenship.

The Maryland Functional Reading Test (MFRT) was first required in the school year 1980-81, the Maryland Functional Mathematics Test (MFMT) in 1983, the Maryland Test of Citizenship Skills (MTCS) in 1983, and the Maryland Functional Writing Test (MFWT) in 1984. No-fault testing was administered in earlier years to establish cut-off scores. Steady increases have been made in both the state and the county with Baltimore County Public Schools consistently having a higher passing rate than the state of Maryland as a whole. See Table 1 for Maryland and Baltimore County Public Schools results. Full implementation of the testing program as a requirement for graduation is planned for the class of 1989 which will be required to pass all four tests in order to graduate.

The first class of ninth graders required to pass the MFWT, the graduating class of 1987, was given a reprieve from that requirement after the Educational Testing Service (ETS) studied the test and found some problems with it (ETS Report to General Assembly, 1986). At the time the study was requested, 13,700

Table 1

Maryland Functional Testing Results*

Year	Test	Baltimore County	State
1980-81	MFRT	85%	78%
1981-82	MFRT	91%	83%
1982-83	MFRT	93%	89%
1983-84	MFRT	96%	93%
1983-84	MFMT	69%	61%
1983-84	MTCS	59%	51%
1984-85	MFRT	97%	93.1%
1984-85	MFMT	69%	61%
1984-85	MFWT	66%	54.1%
1984-85	MTCS	69%	58.7%
1985-86	MFRT	95%	92%
1985-86	MFMT	72.36%	64.9%
1985-86	MFWT	82%	68%
1985-86	MTCS	73.6	66.4%

*Percent Passing Rate for ninth graders

juniors in the state of Maryland had failed the test and were scheduled to be retested. When ETS reported that it was a good test, but that there were several recommendations especially in scoring, a bill was introduced into the legislature to delay the test for two years so that revisions could be made. Before the bill passed, the state superintendent asked for a one-year delay to allow time to make changes in the examination before requiring students to pass it in order to graduate (Englund, 1986). In May, 1986 the State Board of Education approved a second year's delay after hearing Superintendent Hornbeck's plans for revision to the MFWT (MSDE, School Times, 1986). At this time, the class of 1989 and subsequent classes still must pass the MFWT in order to graduate.

Appropriate Assistance

Each local school system provides appropriate assistance as required by law to students not passing MCT's or experiencing difficulty achieving those skills needed to pass MCT's (COMAR 13.03.02.06). The amount of appropriate assistance provided to a student increases as the student continues to be unsuccessful in passing the retests. Appropriate assistance is provided in the context of required courses for most ninth and tenth graders. Independent study is an option for those students who were very close to passing the MCT, and in which the student may work

independently or with student tutors to master the material. Eleventh and twelfth grade students are scheduled for at least one class period of appropriate assistance per week for each MCT failed (Project Basic Office, MSDE, Resource Paper, No. 9, 1985).

Minimum Competency Testing in Baltimore County

As shown in Table 1, Baltimore County Public Schools has consistently had a higher passing rate than the state of Maryland as a whole; however, additional planning and remediation is needed for those individuals who have one or more tests yet to pass before graduation. As of fall, 1985, approximately one-half of Baltimore County Public Schools' tenth graders had not passed or yet taken one of the four MCT's required for graduation. Approximately one-third of the county's eleventh graders had not passed or yet taken one of the three MCT's required for graduation. (Baltimore County, Guidelines for Appropriate Assistance, 1986)

The Guidelines for Appropriate Assistance distributed in February, 1986, stated that the Baltimore County developmental approach to instruction is important and that a continuing increased emphasis on the teaching of basic skills is critical in elementary and middle schools. The goal of Baltimore County Schools is to prepare students prior to the ninth grade, so that they will pass the tests as ninth graders and then move on with

their high school programs. Baltimore County Schools recognizes that there will continue to be those students who will not pass the tests in the ninth grade on the initial try, and that the delivery of appropriate assistance in the high schools will continue to be a problem for several years to come (Baltimore County Public Schools, Guidelines for Appropriate Assistance, 1986).

Summer school review courses have been made available since the summer of 1985 with the MCT retesting on the last day of the course. Eighty percent of the students who took either the citizenship or mathematics test as part of this program passed the test. The summer school program is free of charge and is not required (Baltimore County Public Schools, Janene Kelly, 1986).

The Handicapped and MCT's in Maryland

With action taken in 1981, Maryland included the handicapped in its MCT program fully effective with the graduating class of 1989. Amending COMAR 13A.03.01 by including handicapped students in the MCT program, the Maryland State Board of Education set forth a requirement that all students attending public schools in Maryland would be expected to meet the requirements of enrollment, credit, and competency in order to graduate (Office of Supt., MSDE, Resource Paper, No. 11, 1981).

The program has been phased in over a period of years to afford handicapped students additional time over regular students to prepare for the testing. One schedule was established for Level I, II, and III students, and another phase-in schedule was adopted for Level IV and V students.

Any handicapped student who successfully completes his Individualized Education Program but does not meet the competency requirement because of the handicap is issued a Certificate of Attendance. In addition, handicapped students in Maryland have been exposed to Project Basic objectives from which the competency tests are developed as indicated in the students' IEP.

Handicapped students have been afforded modifications to the testing environment if deemed necessary by their Admissions, Review and Dismissal (ARD) Team (COMAR 13.03.01.04C), have been given prior notice of the graduation requirement, and have been afforded repeated opportunities to take the test prior to graduation with appropriate assistance offered to those students failing the test (MSDE, Resource Paper, No. 11, 1981).

Performance of Handicapped Students on MCT's

The MFRT was the first of the MCT's given in the state and was the first MCT the handicapped population was given. The results on the performance of handicapped students taking the MFRT were reported by the state of Maryland in August, 1984. It was

reported that in 1980, when handicapped students were not required to pass the test in order to graduate, 35% of the handicapped students taking the MFRT passed it, but that in 1982 55% of the handicapped students taking the test passed it. Two-thirds of the handicapped students receiving special education services who took the test and were required to pass it in order to receive a regular diploma passed it as ninth graders. The passing rate on the MFRT for handicapped students has doubled since 1980 (MSDE, Division of Special Education, August, 1984).

Additional information received from the MSDE analyzing the testing results for the 1985-86 school year indicate that 92% of the students in the state of Maryland, including the handicapped, passed the MFRT. There are no further statistics available which separate the performance of the handicapped, because the handicapped are being included in the testing at this point as any other ninth graders (Harper, 1986). Data are available for handicapped students' performance on the MFMT for 1983 and 1984, and show that 10% of all the handicapped ninth graders in the state of Maryland taking the test passed in 1983, and nineteen percent of all the handicapped ninth graders taking the MFMT in 1984 passed it (MSDE, 1986).

Special Education and Appropriate Assistance in Baltimore County

Planning for appropriate assistance for handicapped students takes place as part of the ARD Team process. Special education teachers provide appropriate assistance to handicapped students who are enrolled in a class for which the student has failed the MCT. For instance, a handicapped student enrolled in a special education mathematics class would receive appropriate assistance for mathematics (if the MFMT were failed) within that special mathematics class. Special education students who are mainstreamed for the subject area in which they have failed the MCT receive the same appropriate assistance as the rest of the students in their class (Baltimore County Schools, 1986).

Statement of the Problem

In the fall of 1985, 419 ninth grade handicapped students levels II-IV took the MFMT in Baltimore County Schools. Out of the 419, 284 failed the test. With more than fifty percent of the handicapped ninth graders failing the test, the idea of appropriate assistance becomes even more of a challenge to educators already faced with almost one-third of the regular ninth grade students enrolled in appropriate assistance programs. Mathematics, according to Serow, Davies, and Parramore (1982), is an area of study in which remediation efforts show more success

than in Reading. Handicapped students' performance improved on the MFRT (MSDE, 1984), and it is important to know if handicapped students' performance will improve on the MFMT so that handicapped students will not be denied a regular diploma on the basis of this test. Out of the 284 who failed in Baltimore County, Maryland, only 20% passed the retest after receiving appropriate assistance. No Maryland studies have been completed to allow prediction of which students are likely to pass the test and which students are likely to fail the test.

Given the study population, this study will attempt to determine if it is possible to predict those students who are likely to pass and those who are likely to fail the MFMT, based upon known pupil and program characteristics. It will attempt to further determine if these variables as a group can be used to predict whether the students will pass or fail the MFMT.

Research Question

Given the study population, which of the predictor variables of sex, race, age, handicapping condition, general ability, mathematics ability, level of service, mathematics grade, attendance, and type of appropriate assistance lead to passing or failing the MFMT?

Purpose of the Study

This study should result in the following:

1. Identifying variables in both pupils and programs for a particular group of students which with further research may assist in predicting whether a student will pass or fail the MFMT.

2. Providing Baltimore County Schools with needed research pertaining to the performance of handicapped students on the MFMT.

3. Assisting Baltimore County Schools in developing profiles for high-risk handicapped students in regard to the MFMT.

4. Providing information to assist the parents of handicapped students, the ARD Team, and the student in making decisions regarding whether the student will work toward a regular diploma or a Certificate of Attendance.

5. Assisting Baltimore County Schools in planning and developing appropriate assistance programs for handicapped students failing MCT's.

6. Assisting the researcher and other teachers working with handicapped students to better meet individual needs in regard to MFMT preparation.

Significance of the Study

Research in the area of student performance on MCT's has been limited in general and almost nonexistent for handicapped students. Serow and O'Brien (1983) looked at the remediation efforts with handicapped students in North Carolina where the mildly mentally retarded were not even required to pass the test, Linn, Algozzine, Schwartz and Grise' (1984) evaluated the performance of learning disabled adolescents on Florida's MCT, and Santilli and Fisher (1985) looked at the performance of handicapped students on the Virginia MCT. Additional research is needed to determine, before the actual test who, is likely to pass or fail. This would give the school system important planning information for appropriate assistance programs. It would also help to identify high-risk students so that more emphasis could be placed on learning the skills before taking the MFMT.

Assumptions

1. All students who failed the MFMT in the fall received some type of appropriate assistance between the fall test and the retest in the spring.

2. All students enrolled in a special education Mathematics class have been determined by their ARD Team to have a handicapping

condition which prevents them from benefitting from a Mathematics class in the mainstream.

3. All students who failed the MFMT in the fall and are enrolled in a special education Mathematics class were provided modification to the testing environment if their ARD Team determined that the modification was needed.

Limitations of the Study

This study was limited to the target population of Baltimore County Public Schools handicapped freshmen enrolled in special education mathematics who failed the MFMT in the fall of 1985. Baltimore County, Maryland surrounds Baltimore City like a horseshoe. It is bordered on the east by the Chesapeake Bay, on the west by countryside, on the north by Pennsylvania and on the south by Baltimore City and nearby Washington, D.C. Baltimore County is a blend of rural, urban, and suburban communities. It covers a total land area of 610 square miles and is populated by 665,200 people.

The Baltimore County Public School System is the twenty-fifth largest in the nation enrolling 80,000 pupils on whom an average of $3,890.00 is spent annually per student. Over 5,700 instructional staff are employed with student-teacher ratio

approximately 24 to 1 (Personnel Department, Baltimore County Public Schools, 1986).

Delimitations of the Study

This study was limited to learning disabled and mentally retarded freshmen receiving Levels II-IV service and enrolled in special education mathematics in Baltimore County Public Schools during the 1985-86 school year. This study was further limited to the students who failed in the fall and took the retest in the spring of 1986.

Definition of Terms

Appropriate assistance--(as defined by MSDE) assistance, as soon as the need becomes apparent, to supplement the instructional programs of students who are deficient in the prerequisite skills on which competencies are based or who have failed the MFMT to demonstrate competency on the state competency tests.

Handicapped--(as defined in 20 U.S.C. 1401 (a) (1)) means mentally retarded, hard of hearing, deaf, speech or language impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, or other health impaired children, or children with specific learning disabilities, who by reason thereof require special education and related services.

Special Education--(as defined by 20 U. S. C. 1401 (a) (16)) means specially designed instruction, at no cost to parents or guardians, to meet the unique needs of a handicapped child, including classroom instruction, instruction in physical education, home instruction, and instruction in hospitals and institutions.

Individualized Education Program--(as defined by 20 U.S.C. 1401 (a) (19)) means a written statement for each handicapped child developed in any meeting by a representative of the local education agency or an intermediate educational unit who shall be qualified to provide, or supervise the provision of, specially designed instruction to meet the unique needs of handicapped children, the teacher, the parents or guardian of such child, and whenever appropriate, such child, which statement shall include: (a) a statement of the present levels of educational performance of such child, (b) a statement of annual goals, including short-term instructional objectives, (c) a statement of the specific educational services to be provided to such child, and the extent to which such child will be able to participate in regular educational programs, (d) the projected date for initiation and anticipated duration of such services, and (e) appropriate objective criteria and evaluation procedures and schedules for determining, on at least an annual basis, whether instructional objectives are being achieved.

Mentally Retarded--(as defined in 34C.F.R. 300.5) means significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior and manifested during the developmental period, which adversely affects a child's educational performance.

Specific learning disability--(as defined in 34C.F.R. 300.5) means a disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have learning problems which are the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

Levels of Service--(terms used in Maryland to specify the amount of special education service)

Level I-consultative or assessment (COMAR 13A.05.01.06.E.3.a).

Level II-direct service up to one hour per day (COMAR 13A.05.01.06.E.b).

Level III-direct service up to three hours per day (COMAR 13A.05.01.06.E.c).

Level IV-direct service for more than 1/2 of the school day (COMAR 13A.05.01.06.E.d).

Level V-public special center/school or nonpublic school assigned by Central ARD (COMAR 13A.05.01.06.E.3.e).

Level VI-residential program assigned by Central ARD (COMAR 13A.05.06.06.E).

Level VII-home and hospital instruction (COMAR 13A.05.06).

Chapter 2

Review of Literature

This chapter looks first at Minimum Competency Testing (MCT) programs in general, focusing on the controversy and legal issues involved. The chapter then includes information relative to the handicapped student and MCT's from inclusion, to legal issues, to remediation, and finally to predictions of success or failure on MCT's.

Minimum Competency Tests

Minimum competency tests are being used in 38 states, and 17 of those states used the results for high school graduation for the 1985 graduating class (Pipho, 1984). The tests in general are designed to assess student achievement in certain areas. The tests are pass/fail, and the results are used to make decisions about students. Students who pass may be promoted to the next grade, or receive a regular diploma, while the student who fails may not be promoted to the next grade, may or may not receive a regular diploma, and may receive remediation, etc. (Perkins, 1982).

As recently as September, 1986, poor curriculum/poor standards were identified as the fourth most important problem facing public schools in the Phi Delta Kappa/Gallup Poll of the

Public's Attitudes Toward the Public Schools (Gallup, 1986). The survey revealed that Americans strongly support stricter requirements for high school graduation (Gallup, 1986).

Controversy Over MCT's

Proponents' Arguments

Minimum Competency Testing came into being as a result of the same arguments being stated for its support. These arguments have been summarized by Perkins (1982) into five categories which include the following arguments: "(1) restore confidence in the high school diploma, (2) involve the public in education, (3) improve teaching and learning, (4) serve a diagnostic, remedial function, and (5) provide a mechanism of accountability" (pp. 6-7).

Those in favor of MCT's argue that the use of MCT's has become necessary because of declining test scores, functionally illiterate graduates, rising costs to educate, and diplomas which have no credibility to employers in terms of skills attained by the graduate, (Pipho, 1979, Ebel, 1978, Neill, 1978, NASSP, 1976). Not only would the employers know that graduates with a diploma actually possess minimum skills, but the taxpayer would be getting his money's worth from his tax dollars if students are tested prior to graduation (NASSP,1976). The 1986 Gallup Poll asked whether lesser diplomas should be awarded to those students not

meeting graduation requirements, and only one in five felt that a lesser diploma was more suitable than remediation (Gallup, 1986).

Cohen in 1980 pointed out that proponents for MCT's were responding to public pressure for schools to produce competent graduates, and that this makes the testing movement more a political movement than an educational movement. Jaeger and Tittle (1980) predicted the political effects of MCT's to be the most profound and urged further research be conducted in regard to MCT's. Ross (1982) pointed out that MCT's are a result of society's overall goal to integrate minority students into the schools and that the resulting educational problem stems from a societal problem. Ross (1982) views MCT's as having been chosen by legislators as an objective tool for mainstreaming minorities. As far as educational benefit to students is concerned, Gilman (1978) went back as far as 1959, which is when Denver started using MCT's, and reported that Denver shows stable SAT scores and a declining number of students not achieving basic competencies.

Accountability permeated many of the arguments. Ebel (1978) carried the accountability factor into the accountability of teachers and pointed out that teachers will be motivated to teach better, because test scores are a visible means of assessing student achievement in a particular teacher's classroom. Klein (1984) reported that two studies conducted in California found that MCT's improved instruction through increasing the number of

credits in English for graduation, clarifying goals, and providing better teaching and more inservices. Popham and Rankin (1981) discussed one school system, Detroit, which chose to be held accountable by installing MCT's. The tests, according to Newman, (1979), were expected to provide a means of achieving accountability in education today. The entire argument was summarized by Ebel (1978) when he said, "Tests of minimum competency do not cause failure nor increase its frequency. They only lead to the recognition of it." (Ebel, 1978, p. 547)

Opponents' Arguments

Opponents' arguments were also categorized by Perkins(1982) into the following arguments: "harmful effects of MCT on (1) various populations of students, (2) the curriculum, (3) teachers and administrators, and (4) control of education." (p.8)

In regard to the opponents' concerns for various populations of students, included in their concern were the minority students, the underachievers, and the fact that these students may more likely drop out as a result of failure on MCT's. The handicapped will be discussed in greater detail later in the chapter. The Debra P. v. Turlington case in Florida was based on whether black students were being taught the information on which they were being tested, and certain test items were challenged as being biased. McClung (1978) found many MCT programs to be unfair and

illegal, citing inadequate phase-in, lack of curricular validity, and racial discrimination.

In terms of the curriculum, in addition to McClung (1978), Amos (1980) voiced concern that the tests may become the curriculum. The Kanawha County School System found that agreeing on a definition of minimum and the establishment of minimum competencies was difficult, because there is not general agreement among educators as to what is minimum (Candor-Chandler, 1978). Bracey (1978) pointed out that competence is a learned process and that it should be reinforced instead of mandated.

As far as effect on control of education is concerned, it depends on whether the MCT's are mandated by the legislature or the education department. Archambault (1979) pointed out that the local education unit may feel it has little or no contol in the process when the state mandates statewide testing programs. Even though remediation is left to the local school systems, according to Archambault (1979), little financial support for remediation has been forthcoming from the states mandating MCT programs. Archambault (1979) refered to MCT's as the "educational Edsel of the 80's" (p. 45).

Legal Issues Regarding MCT's in General

Five legal principles were reviewed by Citron (1982, 1983) and included the following: that the appropriate use of MCT's is

constitutional, adequate notice to students must be given, MCT's must not be racially biased, MCT's required for graduation must be content valid, and handicapped students may be required to meet MCT requirements for graduation with a regular diploma. Citron (1982,84) referred to Debra P. v. Turlington which, although focused on the unfairness of the Florida test, did result in a ruling that the state could require passage of a fair test as a diploma requirement, that Florida did not provide adequate time for students to prepare for MCT's required for graduation with a diploma, and that adequate time and opportunity to prepare were rights under due process. Citron (1982,84) further stated that school systems may be called upon to validate the test content in terms of curriculum based upon Debra P. v. Turlington's call for systems to show what they taught in proving content validity. In regard to racial bias, Citron (1982,84) pointed out that Debra P. v. Turlington ruled that school systems must show that students who fail do so not because of educational deprivation and must look at whether the tests impact on special populations negatively.

The Handicapped and MCT's

Pullin (1985) reviewed common practices regarding the inclusion of handicapped students into the MCT process and found the following occurring: states in which handicapped students

have always received a different diploma may now provide an opportunity for a regular diploma to the student previously denied, states in which handicapped students received a high school diploma for merely attending high school now put some of the responsibility on the student, and states which allow handicapped students exemption may deny those students a regular diploma. Pullin (1985) further stated that many school systems provide modifications to the testing environment for the handicapped student, others offer remediation in the form of appropriate assistance, and some present regular diplomas to students finishing an IEP.

Controversy Over Inclusion of the Handicapped in MCT's

Proponents' Arguments

Amos (1980) pointed out that exemption of handicapped students from testing requirements would further set them apart. Cohen (1980) reviewed advantages of the handicapped student's inclusion in the MCT program as being new standards for program development and curriculum, increase in student motivation, reduction of stigma associated with being handicapped if the student passes, an emphasis on early identification of problems, and, a curriculum produced from framework of competencies. The discussion by McCarthy (1980,83) did not focus on being for or against the inclusion of the handicapped but on answering

important questions before the inclusion. Public Law 94-142. The Education for all Handicapped Children Act (EHCA) of 1975, was discussed by McCarthy (1980,83) in pointing out that the IEP should be utilized in meeting the MCT requirement for graduation and that the MCT should complement the student's IEP rather than replace it.

Opponents' Arguments

The opponents of MCT's in regard to handicapped students according to Ewing and Smith (1981) fear that the tests will result in a limitation of the curriculum to those skills being tested, lead to increased stigma and higher drop-out rates among the handicapped, and lead to remediation of basic skills rather than spending the time in areas the student may need more. Students moving from one area to another may find different graduation requirements and, where MCT's are in existence, different testing requirements (Pullin, 1985). Students may be able to graduate in one state, but because the parents move to another state may not graduate because of inability to pass MCT's. Handicapped students may find the experience of failing the MCT's as the deciding factor in determining their own self-worth (Blau, 1980). Cohen, et. al (1980) stated that students who do not receive a diploma will be labelled for life with a Certificate of Attendance. Cohen, et. al (1980) reported that students and

teachers may feel pressure causing frustration instead of motivation. Serow and O'Brien (1983) found in North Carolina that mildly mentally retarded students were more likely to drop out of school after failing MCT's. They also found that remediation efforts were not as successful with the handicapped, and that after the initial retest, the remediation efforts produced even less improvement.

Alternatives To MCT Passage For the Handicapped

Chandler (1982) argued that handicapped students should, along with regular students, leave school when their goals are achieved to eliminate some of the unfairness caused by the denial of diplomas to handicapped students based on MCT's. Ross and Weintraub (1980) discussed four proposals including pass/fail, Certificate of Attendance, completion of the IEP as completion of the requirement for graduation, and a curriculum completion approach determining that individual student needs and flexibility were the vital keys regardless of the approach. Fox and Weaver (1981) referred to competency certificates as potential equalizers to be awarded to those students passing the MCT's in addition to their diploma.

Legal Issues Regarding Handicapped Students and MCT's

McCarthy (1983) stated that handicapped students could be required to pass MCT's in order to receive a high school diploma. She pointed out the right of handicapped students to "individualized instruction designed to address their unique needs, but they are not entitled to individualized diploma standards" (p. 146).

The highest state court in New York in 1983 in the Ambach case held that the handicapped students bringing suit should not receive a high school diploma without passing MCT's and it ruled that three years was adequate notice (Pullin, 1985). A local school system awarded regular diplomas to two handicapped students who had not passed MCT's required for graduation. The school system indicated that the diplomas were awarded because the students completed their IEP's. The New York Education Commissioner Ambach ordered that the names of the two students be revealed so that the students could be notified to return the diplomas. The school system sought and obtained an injunction which barred the Commissioner from receiving the names. The state trial court in 1981 entered a permanent injunction to prohibit the state from forcing the school system to turn over the names of the students (Pullin, 1985).

The case was appealed to the intermediate appellate court which ruled that implementation of a test requirement for graduation with a regular diploma did not violate equal protection of the law under the Constitution. It further held that the two students had no property interest in the diplomas and no liberty interest in the stigma of being labeled incompetent. The court found no violation of Section 504 of the Rehabilitation Act or the Education of the Handicapped Act (EHA). Three years was considered sufficient notice and adequate time to prepare students. Attorney fees were paid for the two students' families, because the school system initiated the litigation (Pullin, 1985). The highest court in New York upheld the intermediate court in 1983, and the United States Supreme Court denied a writ of certiorari in 1984.

In regard to action in federal courts, Pullin (1985) reported that Anderson v. Banks is the result of MCT litigation from Tatnall County, Georgia, where the federal court, in 1982, ruled that Section 504 of the Rehabilitation Act of 1973 does not require that handicapped students be awarded diplomas for which they have not met the standards. The students argued that some of them, because of handicaps, would never be able to pass the MCT's and would not receive a regular diploma. The court suggested that different standards for handicapped students could be appropriate (Pullin, 1985).

Brookhart v. Ill. State Board of Education, the more recent federal case, is the case upon which present policies are being determined (Pullin, 1985). As Pullin (1985) reported, a group of handicapped students in Illinois was denied a regular diploma because they were unable to meet the MCT requirement. Upon appeal, the Seventh Circuit found that the MCT was not the sole criterion for graduation, that Section 504 was not violated, but that infringement of the 14th amendment applied, and that handicapped students should be afforded adequate phase-in time and an opportunity to meet the requirement. The court found that the individuals in Illinois had not been afforded adequate time or opportunity to prepare for the MCT's. It was further established in the Peoria case that accommodations to the testing environment can be deemed necessary (Pullin, 1985). Pullin (1985) suggested that future litigation may center around adequate instruction and special accommodations to the test administration when necessary.

Steps Taken When Students Fail Minimum Competency Tests

Remediation is afforded students failing minimum competency tests. Almost three-fourths of those polled regarding remediation for students failing competency tests required for graduation felt that remediation should be made available (Gallup, 1986). This remediation may be delivered as appropriate assistance, and the two terms are used interchangeably throughout this paper. Wise

(1979) indicated that there is too little known about learning to say that remediation will definitely help students learn the skills. Archambault (1979) raised the concern that not much is known about remediation for MCT's and urged more research in the area. Serow, Davies, and Parramore (1982) examined the extent in North Carolina to which students who initially failed the MCT showed improvements on subsequent reexaminations and sought to identify factors which might account for these improvements. Serow, et. al. (1982) found that students who demonstrated improvement following remediation made the gains more in relation to their program characteristics rather than their pupil characteristics. In other words, Serow, et. al. (1982) found that it was more important to look at how the appropriate assistance was being delivered than to the age of the student. They found students making their greatest gains on the first retest, and making less gains in Reading than in Mathematics. The greater success in remediating Mathematics was explained by Serow, et. al. (1982) by indicating that Reading is influenced more by pupil characteristics, and less by program characteristics, and it is more likely for the schools to improve program characteristics than pupil characteristics. Serow and Davies (1982) also found that remediation efforts were more successful with whites than with blacks when assessing equality of opportunity.

In addition Serow, et. al. (1982) reported that non-handicapped students made greater gains than handicapped students. Serow and O'Brien (1983) found even with more intensive remediation in Reading, the mildly mentally retarded students were still only answering about one half of the test items correctly and recommended that the state of North Carolina exempt the mildly mentally retarded from the MCT's based upon the fact that remediation was not successful with this population and that further failure would be harmful to the individual student. Trachtenberg (1980) cautioned against remediation in high school as possibly being "too little too late".

Mercer and Mercer (1985) reported that academic remediation is more ambiguous in terms of effectiveness with students who have learning problems. Emphasis on remediation is even greater when graduation is linked to passage of MCT's. Mercer and Mercer (1985) recommended that academic remediation may be appropriate for ninth and tenth graders with learning problems but should be provided in conjunction with other services.

Linn et. al. (1984) found that less than half of the 2,257 tenth grade learning disabled students tested on Florida's MCT passed and that poor performance was evidenced most in communication and mathematics. The study pointed out that while these areas are important, remediation in Mathematics and communication should not take away from other curricular areas.

In addition to remediation Amos (1980), Morrisey (1980) and Scott (1983) looked to test modifications as a necessary safeguard for handicapped students taking MCT's. Modifications for handicapped students vary from MCT program to program, but in most cases the decision to make modifications is part of the IEP process (Amos, 1980). Test format and modification in the manner of presentation was discussed by Scott (1983) and Gillespie and Lieberman (1983), and Morrisey, (1980) questioned paper pencil tests as appropriate for handicapped students.

Studies Involved in Predicting Success or Failure on MCT

The handicapped student's IEP committee makes decisions regarding MCT's and decides whether the student will pursue a regular diploma. Limited information is available in the research to guide the IEP Committee in the decision making process.

Wilson (1983) in a doctoral dissertaion looked at predictors for success or failure on the Virginia MCT's for students in general. His goal was to identify students as early as fourth grade who were in need of remediation before taking the MCT. Wilson (1983) found that SRA test scores were the strongest predictors with other standardized test results also coming out as strong predictors. Wilson (1983) further found that the absentee rate for students failing Virginia MCT's was higher than for

students passing. According to Wilson (1983), students with lower grade point averages and lower placements were also less likely to pass. Although Wilson (1983) found no significant relationship among students' family income levels and students' scores, he found students from single parent homes were less likely to pass. Only a slight disparity between blacks and whites and females and males on the Virginia MCT was found by Wilson (1983). He found that there was a relationship between absentee rate, grade point average, placements in English, amount of home support, levels of mathematics, parents' income level, number of parents in the family, race, sex, standardized test scores, and performance on the Virginia MCT (Wilson, 1983). He concluded that students' eighth grade SRA scores should be strongly considered as predictors for passing or failing the Virginia MCT based on a high correlation. One recommendation Wilson (1983) made was for school systems in Virginia to evaluate each student and remediate as early as feasible.

Santilli and Fisher (1985) limited their research of predictors to those predicting the success or failure of handicapped students on the Virginia MCT. Santilli and Fisher (1985) looked at 88 handicapped seniors in Fairfax County, Virginia who were mildly retarded, learning disabled, and emotionally disturbed, 56 of whom had not passed the Virginia MCT's and 32 who had passed the Virginia MCT's. Sex was found to

be significant by Santilli and Fisher (1985); however, they found that males were more likely to pass, while Wilson found in 1983 that nonhandicapped males were more likely to fail the Virginia MCT. Because of the finding regarding sex, Santilli and Fisher (1985) recommended more remediation for handicapped females.

Wilson in 1983 found a slight disparity regarding race while Serow and Davies (1982) found more blacks failing. Santilli and Fisher (1985) found no significant difference in race between those who passed and those who failed. Even though Santilli and Fisher (1985) found no significant difference in race, they recommended that further research be conducted in regard to race.

Santilli and Fisher (1985) found IQ as measured by the Wechsler Intelligence Scale for Children Revised to be significant as related to passing MCT's and found significant and positive correlations between standardized achievement tests and performance on MCT's except during the senior year. This was explained by Santilli and Fisher (1985) by low achievement and the retesting. Reading and Math achievement test scores were found by Santilli and Fisher (1985) to be low predictors, as were number of years in special education, and attendance except in the senior year. Santilli and Fisher (1985) recommended that more extensive research be conducted in the areas of predictors and recommended replication.

Summary

This chapter has reviewed literature regarding MCT's in general and MCT's as applied to the handicapped. The review focused on advantages, disadvantages, legal issues, and finally steps taken when students do not pass MCT's. The review of literature ends with a look at the limited research available to those making decisions in regard to handicapped students working toward a regular diploma in areas where MCT passage is required.

Hypothesis

Based upon the problem and the findings of Serow, Davies, and Parramore (1982) regarding the futility of continued remediation for the handicapped in regard to retests and mathematics and the findings of Wilson (1983) and Santilli and Fisher (1985) regarding ability, sex, race, and attendance as predictors for success or failure on MCT's, a hypothesis was formulated. The hypothesis tested against the null is that the variables of sex, race, age, handicapping condition, general ability, mathematics ability, level of service, mathematics grade, attendance, and appropriate assistance, as a group, can be used to predict whether the student within the study group will pass or fail the retest of the MFMT.

CHAPTER 3

Methodology

This chapter describes the subjects of the study, the instruments from which scores were derived, the procedure for collection of the data, the collection of data, coding of the data, the research design, and the procedures utilized in analyzing the data.

Subjects

Baltimore County Public Schools (BCPS) is a suburban school district surrounding Baltimore, Maryland, in a horseshoe shape. It consists of 80,195 students attending 147 schools taught by over 5000 teachers. Handicapped students make up a population of 9,453 students receiving Levels I-VII of service. The breakdown is presented in Table 2.

Since most Level V and all Level VI and VII students do not receive their special education service in regular secondary schools, they were excluded from the study. Level I students by definition are not included, because if they are registered in a special mathematics class, they become at least Level II.

Table 2

NUMBER OF STUDENTS RECEIVING LEVEL I-VII SPECIAL EDUCATION SERVICES IN BCPS 1985-86

LEVEL OF SERVICE	NUMBER OF STUDENTS
I	664
II	2,916
III	937
IV	2,963
V	1,927
VI	32
VII	14

There were 419 handicapped ninth grade students receiving Level II-IV service and enrolled in a special education mathematics class in BCPS during the 1985-86 school year. From that number, 284 failed the MFMT in the fall testing and make up the number of students from whom the study population was taken. Of that original 284, there were 272 students who took the retest in the spring. The retest followed the delivery of appropriate assistance, most of which was delivered in the students' special education mathematics classes. Out of the students who took the retest, 57 students passed the test, and the rest failed. Approximately 20% of those ninth grade handicapped students taking the retest passed, and approximately 80% failed. The students taking the retest became the study population. They were all handicapped ninth graders receiving special education mathematics who had failed the MFMT in the fall and taken the retest in the spring. Of the study population 69 were black, and 200 were white; 191 were male and 79 were female. The ability levels ranged from the 1st to 6th Stanines, and 146 had earned at least a C in their special mathematics class. Two hundred eight were learning disabled, and fifty-nine were mildly mentally retarded. Two hundred seventy-one of the study population received their appropriate assistance in their special education mathematics class.

Instruments Used

Maryland Functional Mathematics Test (MFMT)

The MFMT is an MCT which is a part of the larger Maryland Functional Testing Program. The test is a group test and is untimed in that students are allowed to work as long as they are "meaningfully engaged with the test" (Questions You May Ask, MSDE, 1982, p.7). There are two levels of the test: Level I administered in seventh grade and Level II, a more advanced version, administered in the ninth grade. Level I serves as a diagnostic tool, while Level II serves as a test used to certify that students meet the state graduation requirement in Mathematics. The first graduating class required to pass the MFMT is the class of 1987. Test results are reported by the MSDE to the parents or legal guardian and to the school. If the student has met the graduation requirement, a P is above the total score on the Level II test, or if the student did not pass, an F is above the total. Level I does not have a pass or fail. Each student's test result form for Level I and Level II shows how the student performed in each domain, and teachers can use this information to provide appropriate assistance before the retest. Once Level II of the MFMT is passed, the student will not take it again.

Passing scores are established by the MSDE upon recommendation of the state superintendent, who considers the recommendations of citizens throughout the state. Alternate forms of the tests are administered with scale scores utilized so that the amount of achievement students need to pass each form remains the same.

The total test score is a scale score and is utilized to compare students' performance. Domain scores are also reported with a range of 0-100 and represent the skill and knowledge a student has in the various domains as a percentage. Domain scores are content scores and are not affected by other students' scores.

Content Validity

The test items are based on the Declared Competencies Index (DCI) also known as Project Basic. The instructional objectives were developed by the state with input from educators, parents, students, political leaders, business people, etc. and were included as instructional goals and objectives all students should be taught throughout Maryland. Test items are based on these instructional objectives. See Appendix for a listing of the DCI for mathematics. Local school systems have incorporated the teaching of DCI's into their curricula. MSDE (Questions You May Ask, 1982) reports that "test specifications serve as a bridge between instruction and testing by providing a detailed

description of the content which will appear on the test." (p. 5) A state item bank consisting of items developed by Maryland classroom teachers, mathematics specialists, and testing experts is used by trained item writers, and from this bank new forms of the test are produced each year. Test items are field tested seven at a time on the MFMT. For instance, the MFMT has 77 items, but the student is scored on only 70.

Reliability

KR20 coeffficients are reported for each test domain and the total test for the MFMT. Reliability information is provided for the 1985 MFMT-II in Table 3. The coefficients for each subtest are somewhat low, because they are computed on only 10 test items in each domain (there is one field test item in each of the domains). The reliability for the total test is KR20=.94 (Ferrara, MSDE, 1986).

Otis-Lennon School Ability Test (OLSAT)

The OLSAT is a group intelligence test that gives a single score referred to as a School Ability Index (SAI). Information regarding standardization, validity, and reliability has been taken from the test administrator's manual (Otis and Lennon, 1979). It was standardized concurrently with the Metropolitan

Table 3

RELIABILITY COEFFICIENTS (KR20)

1985 MFMT-II

Domain	Number of Items	KR20
1. Number Concepts	10	.77
2. Whole Numbers	10	.62
3. Mixed Numbers/Fractions	10	.84
4. Decimals	10	.77
5. Measurement	10	.69
6. Using Data	10	.78
7. Problem Solving	10	.73

Achievement Test on a representative school population of over 130,000 students.

The OLSAT series' validity information shows that correlations between the OLSAT scores and teacher grades for elementary and high school were within a range of .40 to .60, with a median of .49. No description is provided of construct validity.

The OLSAT series' reliability is reported in the manual for administering and interpreting as based on the Kuder-Richardson and test-retest procedures. For the eighth grade, the reliability coefficient reported is .94. For the test-retest coefficients, samples of students in grade 7 but not grade 8 were reported. Grade 7 test-retest stability over a six month interval was .92.

California Achievement Test (CAT)

Form C of the CAT is used, and although the test measures achievement in the areas of Reading, Language, and Mathematics, only the results for total Mathematics were utilized in this study. There are two Mathematics subtests in the Mathematics section--computation and concepts and application. There are 85 total items, and students are given 25 and 35 minutes respectively to complete each subtest. This is a standardized group test. The raw scores are converted to continous scale scores, grade equivalents, percentile ranks, and stanine scores. The stanine scores were used in this study. All standardization, validity,

and reliability information is taken from the technical bulletin (California Test Bureau, 1978).

The CAT was normed in public and Catholic schools in 1977 on 200,000 students from kindergarten through the twelfth grade who were drawn by stratified random sampling procedures. The testing was conducted in the fall of 1976 and the spring of 1977. The schools which participated are reported as being representative of the schools in the nation based upon their responses to a questionnaire dealing with geographic regions and community types. All norming was based on a single, equal-interval scale of standard scores.

In reporting validity, the manual provides category objectives for the mathematics subtests which the school system can utilize in determining whether the tests are content valid for their particular system. In addition, content validity was established by developing test items to test the most common objectives appearing in curriculum guides and instructional materials gathered from all states and major cities.

The reliability for the CAT was reported in the manual for grade 8 as alternate form reliability coefficients. First one form and then the other was administered to the same 300 students. For total mathematics the reliability coefficient was .83.

The correlation coefficients reported for the standardization sample from Fall, 1976, to Spring, 1977, were .88 for mathematics.

Procedure for Data Collection

The following procedures were used in collecting the data in this study:

1. Identify those handicapped ninth graders receiving mathematics in a special education classroom who failed the MFMT in the fall of 1985.

2. Identify those students from the group who failed in the fall who took the retest in the spring.

3. Identify those students from the retest group who passed the retest and those who failed the retest.

4. Obtain the following information from each student's records in the Office of Testing and Pupil Data:

   4.1 Sex of the student

   4.2 Race of the student

   4.3 Age of the student

   4.4 Handicapping condition the student is receiving services under

   4.5 Level of service received in special education

4.6 Attendance of student in number of days absent during the school year through the end of the third quarter (Retest administered at the beginning of the fourth quarter)

4.7 Mathematics grade for the first semester in the special education mathematics class

4.8 SAI score in stanine form from the 8th grade testing and CAT score in Mathematics in stanine form from the 8th grade testing

4.9 Type of appropriate assistance received between the fall testing and the retest

Data Collection

The students' records were studied in the Office of Testing and Pupil Data in BCPS, and the following information was obtained: race, sex, age, handicapping condition, level of service, SAI stanine score on the Otis-Lennon administered in the eighth grade, CAT stanine score on the Total Mathematics Subtest of the CAT administered in the eighth grade, the Mathematics grade for the first semester in the ninth grade, attendance for the first three quarters (the retest was given at the beginning of the fourth quarter), and the type of appropriate assistance (within mathematics class or independent study) received by the

student. Out of the 272, two students were counted twice because of moves within the county, dropping the number to 270.

Coding

1. Criteria scores of status for group classification were coded one for pass and two for fail.

2. Race was coded one for white, and two for black.

3. Sex was coded one for male and two for female.

4. The student's handicapping condition was coded as one for learning disabled and two for mentally retarded.

5. The type of appropriate assistance was coded as one for assistance received within the student's scheduled mathematics class and two for assistance received independently.

6. Mathematics grades were reported as of the end of the first semester. They were gathered as letter grades and translated to average numerical grades for the corresponding letter grades. Ninety-five (95) was reported for students having an A at the end of the first semester, 85 for students having a B, 75 for those students having a C, 65 for those students having a D, and 55 for those students having an E.

7. Stanine scores were reported for the Total Mathematics score on the CAT with the range 1-9. Since 8 was the highest score received by any student in the study, 9 was used to indicate a missing score.

8. Stanine scores were reported for the SAI score on the Otis-Lennon with the range of 1-9. Since 7 was the highest score received by any student in the study, 9 was used again to indicate a missing score.

9. Level of service is delivered on a continuum, so levels of service were reported as they are reported on the student's IEP and are continuous data with 2 representing only the mathematics class being in special education, 3 representing at least one other area than mathematics being included in the service, and 4 indicative of more than half of the student's educational day spent receiving special education services.

Research Design

The research design chosen to determine predictions for membership into each group was a criterion "known" groups design employed to determine the best discriminators for predicting whether a student would be in the pass or fail group. Each of the subjects was placed in a status group of pass or fail based on his performance on the retest. Status became the criterion variable. The student's race, sex, age, handicapping condition, general ability as measured on The Otis-Lennon School Ability Test (OLSAT), mathematics ability as measured on the Total Mathematics Subtests of the California Achievement Test (CAT), attendance, Mathematics grade, level of services received, and type of

appropriate assistance received became the variables being tested for discriminating with pass or fail when alone or in combination with any of the others. The discriminating power of the formula could then be tested against the results already known to determine how many cases would have been classified correctly if this formula had been in existence before the fall testing.

Analysis of Data

The statistical computations for this study were carried out by utilizing the SPSSX computer program. The frequencies and distributions were examined for each group on each of the predictor variables. The shape of the distribution was assessed to determine whether the assumptions for discriminant analysis were met. A step-wise discriminant analysis procedure was employed to determine which variables in conjunction with which other variables were good predictors of success or failure on the retest of the MFMT. Many subjects had missing SAI and/or CAT scores, so a conservative procedure was used in order to substitute for missing values. The grand mean for all valid SAI and CAT scores was determined and substituted for any subject whose score was missing.

Summary

Two hundred seventy students who were retested on the MFMT in the spring after failing it in the fall were compared as to their

pupil and program characteristics. Data were collected on ten variables for all subjects, and a stepwise discriminant analysis was performed to determine which pattern of variables was the best discriminator for these subjects for passing or failing the MFMT. The accuracy of the discriminant function was tested to determine how often the discriminant function would correctly classify these students in the pass or fail group.

CHAPTER 4

Findings of the Study

This chapter presents the statistical analysis of the findings of this study. The information is presented in three sections. The first section presents basic descriptive statistics concerning the groups included in the study. The second section presents information relative to each variable and its discriminating power as a predictor for membership in the pass or fail group. The third section presents data indicative of the extent to which the discriminant function formula can be used to correctly predict group membership for the students in the study.

Description of Groups

The distributions of all the predictor variables for both groups were checked for normality by examining measures of kurtosis and skewness. Out of the study population of 270, 57 students passed the retest, and 213 failed. See Tables 4 and 5 for distribution and basic statistics regarding the variables. It is important to note that discriminant analysis requires that the predictor variables be measured by interval or ratio scales, however, dichotomized variables are often used and interpreted with caution. In regard to violating the assumptions of normality and homogeneity of variances, discriminant analysis is

Table 4

Frequencies and Percentages of Predictor Variables by Criterion

Variable	Frequencies		Missing Values		%ages	
	Pass	Fail	Pass	Fail	Pass	Fail
Race			0	1		
White	45	155			79%	73%
Black	12	57			21%	27%
Sex			0	0		
Male	47	144			82%	68%
Female	10	69			18%	32%
Age			0	1		
14	13	30			23%	11%
15	28	126			49%	59%
16	14	52			25%	25%
17	2	4			4%	2%
SAI Stanines			33	114		
1	1	33			5%	33%
2	3	33			12%	33%
3	6	19			28%	18%
4	10	9			40%	8%
5	2	5			8%	5%
6	2	0			8%	0%
CAT Stanines			33	118		
1	0	25			0%	26%
2	4	21			17%	22%
3	5	23			21%	24%
4	8	20			33%	21%
5	5	6			21%	7%
6	2	0			8%	0%
Attendance			0	0		
Absent <10 days	36	117			63%	55%
Absent 10-19 days	12	56			21%	26%
Absent 20 or more days	9	40			16%	19%
Mathematics Grade			0	0		
A	1	3			2%	1%
B	17	42			30%	19%
C	16	67			28%	31%
D	12	57			21%	27%
E	11	44			19%	22%
Handicapping Condition			2	1		
L.D.	53	155			96%	73%
M.R.	2	57			4%	27%
Level of Service			0	0		
2	4	12			7%	6%
3	14	19			25%	9%
4	37	182			68%	85%
Type of Assistance			0	0		
In Class	56	215			98%	96%
Independent	1	8			2%	4%

Table 5

Kurtosis and Skewness Measure for All Predictor Variables by Criterion

Variable	Kurtosis		Skewness	
	Pass	Fail	Pass	Fail
Race	0.13	- .91	1.46	1.05
Sex	1.11	-1.44	1.75	.16
Age	-0.32	0.09	.30	0.22
SAI Stanines	0.27	-0.08	0.00	0.81
CAT Stanines	-0.72	-1.09	0.02	0.20
Attendance	3.79	10.49	1.91	2.73
Mathematics Grade	-1.14	-0.99	-0.20	0.03
Handicapping Condition	15.15	- .91	4.08	1.05
Level of Service	2.13	5.52	-1.42	-2.57
Type of Assistance	57	22.21	7.55	4.90

NOTE: Non-zero values for both measures of Kurtosis and Skewness indicate deviation from normality. Values greater than an absolute value of 1 tend to suggest violation of the normality assumption.

fairly robust, therefore, any predictor variables whose group distributions violated the assumptions were not excluded from the analysis. Extreme violations will be pointed out.

As can be seen in Tables 4 and 5, for the passing group the distribution for attendance, race, sex, handicapping condition, and type of assistance positively skewed and clearly violated the normality assumption, while level of service was negatively skewed. The kurtosis value for mathematics grade and sex were marginally acceptable, while attendance, level of service, type of assistance, and handicapping condition were unacceptable. The dichotomous variables did not have an even split. The distributions for the handicapping condition variable and type of appropriate assistance variable, dichotomous variables, were both unacceptable. For the failing group, as can be seen in Table 4 and 5, the distribution for type of appropriate assistance (a dichotomous variable) was not an even split. Level of service (only four categories) is negatively skewed and violated the normality assumption. The type of assistance, attendance, race and handicapping condition are positively skewed and violate normality. A log transformation was performed on level of service and on attendance to normalize the distribution but the transformation did not substantially alter the shape of the distribution; therefore, the nontransformed variable was kept in the analysis. The Kurtosis values for type of assistance, level

of service, and attendance for the failing group were unacceptable. Sex and CAT were marginally acceptable. All predictor variables were included in the analysis because of the robust nature of discriminant analysis (Sherman, July 28, 1986).

Examination of the sample variances for the two groups on each of the ten predictor variables revealed no major inequalities. The ratio of the largest to the smallest variance for the most discrepant predictor was handicapping condition, where the ratio was 3.81:1 for the failure versus pass groups. That is, there was more variance in the handicapping condition for students failing than for students passing. The sample sizes for the two groups were fairly discrepant with almost 3 and three-fourths as many students who failed as students who passed (With the use of two tailed tests and reasonable homogeneity of variances, discriminant function procedures can be expected to be robust enough to handle this discrepancy in sample sizes).

An examination of each group's covariance matrix revealed that the passing group had a greater number of larger covariance values than did the failing group (It is generally noted that if the larger sized sample produces larger covariances a conservative alpha level is produced. If, however, the smaller sized sample produces larger covariances, then the statistical tests are too liberal). This result suggests extreme caution in interpreting significant findings.

Examination of the correlations among the predictor variables revealed a number of statistically significant results (two-tailed tests, with P at the .05 level or lower), which include the following: SAI and CAT correlated negatively with race (r = -.22;, r = - .22 respectively), which indicated that blacks compared to whites had lower SAI and CAT scores. CAT correlated positively with SAI (r = .45), in that students with high CAT scores tended to have high SAI scores. Mathematics grade correlated negatively with age (r = - .18) and attendance (r = -.31) which indicated that older students and students who miss school more tend to have lower mathematics grades. Handicapping condition correlated positively with sex (r = .14), indicating that males compared to females were more likely to be labelled learning disabled than mentally retarded. Level of service correlated negatively with SAI (r = - .27), indicating that the higher the level of service, the lower the SAI. Level of service also correlated positively with handicapping condition (r = .16), in that more students at the higher levels of service were labelled mentally retarded than learning disabled. Type of appropriate assistance had a positive correlation with race (r = .17), indicating that more whites than blacks received appropriate assistance in the mathematics classroom as opposed to independent study.

The univariate results, testing the relationship between each predictor variable by itself and the criterion variable (status), indicated that the following variables were significantly related to passing or failing the retest of the MFMT: SAI, CAT, Handicapping condition, level of service, and sex. See Table 6 for the list of all the variables and associated F and p values. See Table 6 for univariate results.

Results (see Table 7) indicate that those students who passed the retest of the MFMT tended to have higher SAI scores (M = 3.63) than those who failed (M = 2.20) and higher CAT scores (M = 3.83) than those who failed (M = 2.59). Those who passed (M = 1.05) the retest also were more likely to have been labelled learning disabled than those who failed (M = 1.27), tended to receive a lower level of service (M = 3.58) than those who failed (M = 3.80) and were more likely to have been males passing (M = 1.18) while those failing were less likely to have been male (M = 1.32).

Discriminant Analysis

A discriminant function analysis was performed using the ten variables as predictors of membership in the two groups. Predictor variables were sex, race, age, general ability (SAI), mathematics ability (CAT), mathematics grade, attendance, handicapping condition, level of service, and type of appropriate assistance. Groups were students who passed and students who

Table 6

Univariate Results of Predictor Variables

Variable	F	p
SAI Stanines	27.07	0.00*
CAT Stanines	16.13	0.00*
Handicapping Condition	12.15	0.00*
Level of Service	7.17	0.01*
Sex	5.50	0.02*
Mathematics Grade	1.67	0.20
Attendance	0.85	0.36
Race	0.53	0.47
Assistance	0.52	0.47
Age	0.17	0.68

Table 7

Group Means and Standard Deviations for All Predictor Variables by Criterion

Variable	Mean		S.D.	
	Pass	Fail	Pass	Fail
Race (White = 1 Black = 2)	1.21	1.27	0.41	0.44
Sex (Male = 1 Female = 2)	1.18	1.32	0.38	0.47
Age	15.09	15.14	0.79	0.67
SAI Stanine	3.63	2.19	1.21	1.15
CAT Stanine	3.83	2.59	1.20	1.26
Attendance (# of days)	11.09	12.79	11.32	14.24
Mathematics Grade	72.37	70.45	11.42	10.70
Handicapping Condition (L.D. = 1; M.R. = 2)	1.05	1.27	0.23	0.44
Level of Service (2-4)	3.58	3.80	0.73	0.52
Type of Assistance (1 = in class 2 = individual)	1.02	1.04	0.13	0.19

failed the MFMT retest. Of the original 270 cases, five were dropped from the analysis due to missing data, and grand mean substitutions were made for missing data on the SAI and CAT variables. Assumptions for normality and group variances-covariances were violated, in some cases, as pointed out earlier. In fact, in a direct statistical test of the covariances, analysis indicated that this assumption had in fact been violated, Box's $\underline{M}$ (21,36228) =70.17, $\underline{p}<.0001$. Therefore, extreme caution should be exercised in utilizing the findings of this study. Although it is not the ideal situation, with caution the findings can provide needed information.

A step-wise discriminant function was calculated with a Chi Square (6)= 43.09, $\underline{p}<.0001$, with a canonical correlation of .39 indicating that the discriminant function provides a moderate degree of association between discriminant function scores and group membership. That is, the discriminant function to a moderate degree separates those likely to fail from those likely to pass. The predictor variables which contributed significantly to the differentiation of students who passed from those who failed were: SAI, handicapping condition, sex, mathematics grade, CAT, and race. The other variables either did not provide any discrimination or were providing redundant information. See Table 8 for a summary table of Wilk's Lambda for all variables.

Table 8

Wilk's Lambda Summary Table for All Predictor Variables

Variable	Wilk's Lambda
Race	.85063
Sex	.86131
SAI	.89121
CAT	.85410
Mathematics Grade	.85836
Handicapping Condition	.86784
Age	.84722
Attendance	.84512
Level	.84529
Assistance	.84439

A loading matrix of correlations between predictor variables and the discriminant function, as seen in Table 9, suggests that the primary variable in distinguishing between those failing and those passing is SAI scores (r = .76) CAT scores (r = .58) and handicapping condition (r = .51) show the next highest associations with the discriminant function, while sex (r = .34), level of service (r = .27), and mathematics grade (r = .19), and race (r = .11) show lower degrees of association with the discriminant function.

The standardized discriminant function coefficients provide information in regard to the importance of the variables' contribution to the discriminant function. See Tables 10 and 11 which show the SAI contributes most heavily to the discriminant function followed by handicapping condition, sex, mathematics grade, CAT and race. Some of the predictor variables are not as predictable now because of intercorrelations such as between SAI and CAT.

The standardized discriminant function formula becomes $D=.17B_1+(-.33)B_2+.65B_3+.26B_4+.30B_5+.41B_6$. Where B_1, is a subject's score on race, B_2 is a subject's score on sex, B_3 is a subject's socre on SAI, B_4 is a subject's score on CAT, B_5 is a subject's score on mathematics grade and B_6 is a subject's score on handicapping condition. The four variables not in the discriminant function are type of appropriate assistance,

Table 9

Correlation Between Discriminant Function and Variables

Variable	Correlation Coefficient
SAI Stanines	0.76
CAT Stanines	0.58
Handicapping Condition	0.51
Sex	0.34
Level of Service	0.27
Mathematics Grade	0.19
Race	0.11
Age	0.08
Type of Appropriate Assistance	0.04
Attendance	0.01

Table 10

Importance of Variables After Step-Wise Discriminant Analysis

Variable	F to Remove	p
Race	1.02	.00
Sex	4.27	.00
SAI	13.38	.00
CAT	2.08	.00
Mathematics Grade	3.38	.00
Handicapping Condition	6.26	.00

Table 11

Discriminant Function Coefficients

Variable	Function
Race	0.17
Sex	-0.33
SAI	0.65
CAT	0.26
Mathematics Grade	0.30
Handicapping Condition	0.41

attendance, level of service, and age. The best discriminator, then, of students passing or failing the retest of the MFMT was the pattern of 6 variables: race, sex, SAI, CAT, methematics grade, and handicapping condition resulting from a step-wise discriminant analysis.

Accuracy of Discriminant Function

In addition to doing the discriminant analysis (in order to determine the importance of each predictor variable), the analysis was used to produce a classification matrix in order to determine the proportion of cases that the discriminant function classified correctly (74% of the cases). See Table 12. It can be seen from Table 12 that the discriminant function was more accurate in classifying those who failed (76%) than those who passed (68%). Tau, a proportional reduction in error statistic, was calculated and revealed that the classification based on the discriminating variables made 6% fewer errors than would be expected by random assignment.

Summary

The best discriminator of students passing or failing the retest of the MFMT for the study population was the pattern of variables: race, sex, SAI, CAT, Mathematics grade, and handicapping condition which were determined as the result of a

Table 12

Classification Accuracy for the Discriminant Function

		Predicted Group: Pass	Predicted Group: Fail	
ACTUAL GROUP	PASS	(68%) 38	(32%) 18	56
	FAIL	(24%) 52	(76%) 160	212

NOTE: Numbers in cells represent frequencies, while numbers in parentheses represent percentages.

step-wise discriminant function. This research looked at two hundred seventy students who took the MFMT retest in the spring of 1986 after failing it in the fall of 1985. Data were gathered and analyzed in the form of ten predictor variables for each student passing and/or failing. A large number of students were missing SAT and/or CAT scores, so the Grand Mean was substituted. Some distributions were not normal and were noted in the chapter.

The univariate results indicated that sex, SAI, CAT, handicapping condition, and level of service when looked at alone were significant. The combination of all ten predictor variables was looked at through a discriminant analysis, and a discriminant function was the result. The discriminant function was weighted so that those variables accounting for a greater percentage of the variance were identified for the study population. SAI was the heaviest weighted predictor variable in the discriminant function followed by handicapping condition, sex, mathematics grade, CAT, and race. Race, which was not significant when looked at alone, became a part of the discriminant function. Mathematics grade, which was not significant in the univariate results, became part of the discriminant function.

In a classification of accuracy, the discriminant function proved to be accurate in classifying 74% of the cases. Most of the predictor variables in the discriminant function are pupil characteristics. The study showed that certain pupil and program

characteristics in combination discriminate between passing and failing the MFMT for the study population.

Chapter 5

Summary of Findings

State bylaws in Maryland (Code of Maryland (COMAR) 13A.03.01) include handicapped students in a competency test requirement for graduation. The first group of handicapped students required to pass all four tests in addition to completing attendance and credit requirements in order to receive a regular diploma is the class of 1989. Safeguards established to protect the rights of handicapped students in this endeavor include modifications to the testing environment, appropriate assistance, repeated attempts to pass the tests, the right to instruction in the competencies being tested, notification of the requirement, and an adequate phase-in period. The only safeguard applying specifically to handicapped students is the modification safeguard. In addition, the phase-in period for handicapped students has covered a longer period of time, and the appropriate assistance is for the most part provided by the special educator.

Baltimore County Public Schools (BCPS) has accepted the task of providing appropriate assistance to all students failing any of the competency tests; however, little research is available to determine how successful handicapped students will be on the retests after receiving appropriate assistance. Serow and O'Brien (1983) conducted research on handicapped student performance on

competency test retests and found that mentally retarded students did not seem likely to pass even with remediation.

In order to plan for a handicapped student's Individualized Education Program (IEP), a decision has to be made in regard to the route the student will take in high school. If the handicapped student takes the route of working toward a regular diploma, the IEP must reflect the attempts made to enable the student to succeed. If, on the other hand, the parents, student, and other members of the Admission, Review and Dismissal (ARD) Team are faced with the situation in which the student has failed a competency test, a decision is made as to whether the student should work toward a regular diploma or a Certificate of Attendance. Additional information is necessary to make this decision.

The prediction as to how effective remediation might be is vital to a total picture of the situation facing the student. Although two studies (Santilli and Fisher, 1985, and Wilson, 1983) were designed to predict success or failure on competency tests, only Santilli and Fisher's study centered on the handicapped. Although all of the tests must be passed in order to receive a regular diploma in Maryland, Serow and Davies (1982) found that students made greater improvement in mathematics than in reading. Improvement has been shown (See Table 1) in the state of Maryland in remediating students to be successful on the Maryland

Functional Reading Test (MFRT). It would seem important to determine if remediation will lead to success for handicapped students on the Maryland Functional Mathmatics Test (MFMT).

The primary purpose of this research was to find out which pupil and program characteristic variables discriminate between a particular group of handicapped students passing the MFMT retest and failing the MFMT retest. The results indicate that of the group in the study, students who passed and students who failed differ significantly in their pupil and program characteristics. Handicapped students in Baltimore County who were more likely to pass the retest were learning disabled, white, male, with an average School Ability Index (SAI) score in the third stanine, a California Achievement Test (CAT) score in the third stanine, and a C average in mathematics.

Two hundred seventy learning disabled and mildly retarded students who failed the MFMT in the fall were retested in the spring after having received appropriate assistance either in their mathematics class or through independent study. Data were gathered for the pupil and program characteristics of sex, race, age, general ability as measured by the Otis Lennon School Ability Test (OLSAT), mathematics ability as measured by the CAT, mathematics grade, attendance, handicapping condition, level of special education service received, and type of appropriate assistance received. The students were divided into those

students passing the MFMT and those students failing the MFMT, and a step-wise discriminant analysis was conducted to determine which pupil and program characteristics discriminated between passing and failing. The discriminant function was accurate in classifying 76% of the students who failed and 68% of the students who passed. Tau was calculated and revealed that the classification made 6% fewer errors than would be expected by random assignment. Tau is useful when the dependent variables are dichotomous and therefore not continuous. Using the 80% pass and 20% fail information from the data, one could predict with 67% accuracy. Using the discriminant function, one only betters his prediction accuracy by 6%. If the researcher had found more variance and been able to use continuous dependent variables, the results may have been more meaningful.

Discussion of the Findings

The analysis of data left six variables as members of an equation to predict passing or failing the retest of the MFMT for the group of handicapped students in the study. The six variables were as follows: SAI stanines, handicapping condition, sex, mathematics grade, CAT stanines, and race. The variables of general ability as measured by the OLSAT and mathematics ability as measured by the CAT were both in the formula. Although two other studies (Santilli and Fisher, 1985, and Wilson, 1983) both

found that ability was involved with students passing or failing competency tests, caution must be exercised in looking at the results of the present study.

Almost 50% of the scores were missing from students' records. The researcher substituted the grand mean rather than using the mean of those passing and those failing to take a more conservative approach. The data were not as trustworthy as one would have liked, so the conservative approach was chosen and significance was attempted to be disproven. The results were also interpreted with the 116 who had neither a missing SAI or CAT, and were almost identical.

The CAT variable did not appear as important in the discriminant function as in the univariate results. The intercorrelation of CAT and SAI was so high that CAT dropped in importance. Students having a high SAI score for the most part had a high CAT score also. One must take into account, however, that both the OLSAT and the CAT require reading and are group tests. Indeed, students would not be identified as handicapped based upon these two measures alone.

Handicapping condition was the second heaviest weighted predictor variable in the discriminant function for students in this study. Handicapping condition was also significant in the univariate results.

The learning disabled student in the study group was found more likely to pass than the mentally retarded in the study group who would be, by definition alone, expected to require more intervention at an earlier stage in schooling. Ewing and Smith (1980) warned that before handicapped students were included in the testing requirement, heterogeneity within each category of handicapping condition must be considered carefully. A learning disabled student with dyscalculia presents a much different problem than a learning disabled student with dysgraphia. Ewing and Smith (1980) further spoke to the inclusiveness of the terminology handicapped students. The present study has focused on the two most widely served handicapped populations in special education mathematics in BCPS, the mildly mentally retarded and the learning disabled.

Keeping in mind that not all mentally retarded or learning disabled students are alike, certain generalities can be made. The mentally retarded student in the study group would not be expected to have SAI scores as high as the learning disabled in the study group, unless the learning disabled student's lack of reading ability caused the learning disabled student to score lower on the group test. The CAT would be expected to be low for the learning disabled students in the present study if membership in special education mathematics class is indicative of a disability in mathematics. The mentally retarded students in the

present study, on the other hand, would be expected to score in the first or second stanine on everything. It is important to look at the students' scoring in the first and second stanines carefully to determine whether they scored low because of their reading problem or because of lack of ability. If the student's scores are reasonably reliable, a strong predictor of failure or passing of the MFMT seems to be available for the group in the study.

Sex was found to be a significant member of the group of predictor variables included in the discriminant function for the handicapped students in the present study. Santilli and Fisher (1982) and Wilson (1983) also found sex to be a significant characteristic in determining who will pass and who will fail MCTs; however, Santilli and Fisher (1985) found females failing the tests more often, and Wilson found non-handicapped males failing the tests more often. Although figures vary widely, as early as 1976, Lerner was stating that four to six times as many boys as girls were being diagnosed as learning disabled; however, girls tend to have more difficulty in mathematics. Serow and Davies (1982) found sex to interact significantly with type of remediation and found that girls benefitted more from individual remediation and that boys benefitted more from small group remediation. Since the present study found the student's sex to be a predictor when in conjunction with other characterisitics,

earlier intervention and possibly a more individualized remediation should be considered for the female handicapped students in the present study.

The student's mathematics grade was included in the discriminant function for the handicapped students in the present study. Students with higher mathematics grades in the study were found more likely to pass the MFMT retest when this factor was in conjunction with other characteristics. Mathematics grade was not a significant variable when looking at the univariate results. Wilson (1983) also found that non-handicapped students with lower grade point averages in mathematics were more likely to fail the Virginia MCT. A grade in mathematics is subjective because of student teacher interaction and can be affected by extraneous variables such as the overt behavior of the student. The value of looking at this variable may be in motivation. Motivation is one key to making good grades, and if a student is motivated daily to work on mathematics skills, that same student may also be motivated to try on the MFMT. Students who are not motivated to learn present a perplexing problem to teachers attempting to teach them the competencies needed to pass the functional tests. Teachers will require inservice and/or additional training in motivating students to learn. A tool reported as being a motivator to handicapped students by Withrow, Withrow, and Withrow (1986) is the computer. Samuels (1986) suggests that motivation

be instilled by comparing school to a marathon. He further explains that students can be motivated when they are taught that what they do in school affects their lives outside of school. Linn et. al. (1984) suggest that remediation take place within the framework of academic and vocational areas.

One approach used to teach mathematics to handicapped students in an adapted curriculum is to use the calculator as the tool to solve mathematics problems, however, a handicapped student is not allowed to use a calculator while taking the MFMT because it would not be testing his knowledge of basic skills. The goal for instruction needs to be defined as to whether it is the goal for handicapped students to pass the test or to be able to solve life problems using those resources available to him. The goals of society and schools may not be in the best interest of certain students. ARD Teams are encouraged to do what is best for individual students in determining the appropriate plan for each individual.

Wilson (1983) also found that non-handicapped students with lower grade point averages in mathematics were more likely to fail the Virginia MCT. The MFMT competencies require memorization, sequencing, and organization on the part of the student, therefore additional training in teaching and reinforcing these skills among handicapped students is needed. Looking at the achievement potential of the mentally retarded, it does not seem necessary to

have a test such as the MFMT to encourage teachers to teach the student basic skills or to motivate the student to learn basic skills. Additional research should focus on the learning disabled adolescent. Not only are teachers remediating mathematics, but they are also working with the learning disabled adolescent who is frustrated by his learning problem in addition to his normal difficulties with adolescence.

The race of the student has been significant in other studies as a characteristic affecting non-handicapped student performance on MCT's and was included as a member of the discriminant function in the present study. Serow and Davies (1982) and Wilson (1982) found that race was a factor, and one of the arguments against MCT's has been that they are biased and black students would be further segregated by the test results. Santilli and Fisher (1985), however, found no significant difference in handicapped students results based upon race. It should further be noted that in the present study, when looking at the univariate results, race was not significant, therefore, race may be only a factor when in combination with other pupil and program characteristics. If, indeed, as this study shows, race is a characteristic when in conjunction with other factors, earlier intervention and more stringent remediation may need to be made available to black, handicapped students.

A school system cannot change sex, race, or general ability. The school system can, however, plan accordingly and provide more intense remediation to those students who may exhibit difficulty in learning the declared competencies, or it can arrive at a decision to teach the student to compensate for lack of skill and direct the student toward a Certificate of Attendance.

Appropriate assistance resulted in being almost the same type of service for all students in the sample population and may not be discriminating as a predictor, because almost everyone is getting the same kind. This is not to take away from the importance of appropriate assistance, which remains a vital part in remediating students.

Appropriate assistance delivered within the special education mathematics class provided by the special educator was found to be the case for 98% of those students in the present study who passed and for 96% of those students in the present study who failed. Special educators are provided additional sets of practice problems in the mathematics declared competencies, and all schools have computer programs to generate additional problems dependent upon the needs of the individual students. In an independent-study approach, the student would complete these problems on his or her own at home and return them to the teacher for a brief explanation. The pull out program would involve the student's working with a teacher or tutor in a one-to-one or small

group situation on a particular competency until mastery is achieved. Further research is needed to determine which approaches are most likely to provide handicapped students the skills needed to pass the MFMT and the other three tests required in the state of Maryland.

A goal of special eduation is to meet individual needs. In most cases, the ninth grade handicapped students in the current study were receiving remediation within the confines of their regular special education mathematics class. They may be better served with more intense remediation if delivered in a pull-out situation with aides or parent volunteers providing remediation designed by the teacher. It may be too much of a job for any teacher of a special eduation mathematics class to provide remediation in addition to teaching the curriculum. The teacher may, in this situation, have part of the class who has passed the test and part who has failed it. Even though the classes are designed to meet individual needs, some grouping usually takes place. The students who have opted with the consent or advice of their ARD Team to work for a Certificate of Attendance rather than a diploma may jeopardize the efforts of the teacher to prepare the rest of the class for the test. Those students not taking the test may need to have instruction in use of the calculator rather than the memorization of mathematics facts. Without increased funding the job seems formidable, and with increased funding the

job remains a challenge to be studied as to effective types and methods of mathematics instruction.

Attendance, although not in the final group of discriminators, when looked at alone, showed that more of the students in the present study who passed the retest had lower numbers of days absent. Santilli and Fisher (1985) found attendance to be a factor in handicapped students passing of Virginia's MCT. This is an area which will require both parent and school system cooperation. Pupil personnel workers may find parents more receptive to encouraging attendance if the parents understand the possibility of a link between atttendance and passing the test.

Level of service was significant when looking at the univariate, but it did not become one of the discriminators for the study group in the formula possibly because of the high correlation with handicapping condition. Students who are level III are more likely to be learning disabled than mentally retarded in the BCPS; therefore they have received more of their education in regular education than in special education and may have had more exposure to the declared competencies in elementary school than level IV students. Those in the present study who passed the retest tended to receive a lower level of special education service.

On a post hoc basis, the researcher looked at five handicapped students who passed the MFMT on their first try. Of the five cases reviewed three of the five were male, all of them were white, four of them had SAIs of 3 or more, four of them had CATs of 3 or more, and that the average mathematics grade for the group was C. This group was not delivered appropriate assistance, because their initial attempt on the MFMT was a successful one. This profile is that of the student found in the study most likely to pass the retest of the MFMT.

Limitations of Study

The lack of normality or only marginal normality in certain variables should be noted. In addition, certain dichotomous variables did not have satisfactory splits and might have emerged stronger if the split had been more desirable.

Recommendations

Based on the findings of the present study, it is recommended that:

1. The study should be cross-validated with other groups of handicapped students.

2. The study should be replicated with the other three MCT's to determine what predictors of success or failure might overlap.

3. A study be conducted determining which types of remediation would be effective with handicapped students on each of the MCT's.

4. A study be conducted utilizing continuous dependent variables to provide more variance and also the addition of socioeconomic status as an independent variable.

5. Additional research is needed for:

   a. additional knowledge on remediation techniques as coupled with the acquisition of basic skills

   b. the development of a decision-making approach model in planning for those students predictors indicate will not pass the MFMT as to whether to opt for the Certificate of Attendance rather than a regular diploma.

   c. the examination of other variables which may predict the success or failure of students on MCT's such as socioeconomic status, teacher prediction, etc.

   d. the choice of delivery of appropriate assistance via teacher or in a pull-out situation

e. the availability of assistance from the state education agency in remediation efforts both financially, possibly even categorically, and in the form of teacher-training.

Implications of the Study

In the move to include handicapped students in the Maryland MCT program the implication from this study is that many handicapped students who formerly received regular diplomas may not receive them in the future, and that remediation efforts with the handicapped may not be more or even less successful than the 20% found in this study each year. Serow, Davis, and Parramore (1982) also found that although improvements were made on the first retest, on subsequent retests the improvement was not as great for handicapped students as on the first.

School systems must continue to remediate; however, they receive little financial assistance from the MSDE and spend much of the remedial time teaching students the same basic skills over and over again in the same method as before. The scenario becomes one in which the student continues to fail to grasp the basic skills, becomes frustrated and drops out. The discriminant function formula from this study that has been validated with further research may be used with caution by BCPS to determine which students are likely to pass or fail; or a model based upon

the findings that have been validated with further research may be utilized.

A possible model, if validated by further research, ARD Teams may employ to make decisions regarding handicapped students working toward a regular diploma or a Certificate of Attendance would be based theoretically on decision-making models for other team decisions.

One kind of information seeking procedure which may with further research be validated would follow a six-step model.

1. Identify a need

A student who has failed MFMT-I in the seventh grade would be determined to have a need. A student who has failed MFMT-II in the ninth grade or on a retest would have a more severe or critical need.

2. Look at relevant pupil data.

A student who has failed the MFMT-I or II will have domain strengths and weaknesses reported on a percentage basis for each domain. These scores can be used to determine how severe the student's problem actually is. In addition to domain scores, the general ability information should be considered, as well as achievement in mathematics testing, mathematics grade, handicapping condition, and other data the team feels pertinent.

3. Predict success or failure of the student on retests of the MFMT based on a profile of students likely to pass or fail developed from a discriminant function analysis. If failure is predicted, discuss the possibility of the student working toward a Certificate of Attendance and learning alternative approaches to functional mathematics.

4. Recommend the intensity of remediation to be utilized in preparing the student for MFMT retests.

5. Determine whether additional modifications to the testing situation would be of benefit to the student.

6. Follow-up as soon as test scores are returned from MSDE, and determine whether appropriate assistance was noteworthy in improving the student's score. It is then vital to go back to the first step in the model.

Implementation of this model following validation by further research would require a commitment from local team members and the student's family. The decision not to work toward a regular diploma is one of the most important educational decisions ever made regarding a mildly handicapped student; therefore, it is important that the parents and the student be actively involved in the decision-making process.

In summary, this study introduced research on pupil and program characteristics which predict success or failure on the MFMT. Given this group of handicapped students, meaningful distinction was found in general ability, mathematics ability, mathematics grade, handicapping condition, sex, and race as predictors of success or failure. The most significant discriminants seem to be in pupil characteristics. The discriminant function proved to be accurate in classifying 74% of the cases. It was slightly more successful in predicting failing than passing. The discriminant function provided predictors of success and failure resulting in a profile of those handicapped students in the present study more likely to pass the retest of the MFMT. The results should be utilized with caution, however, because of a bad split between the dichotomous variables and the lack of variance between the two groups in many of the independent variables. As a result of having predictor information for the handicapped students in the present study, a model was discussed as one kind of information seeking procedure for use in team planning utilizing that information if validated with further research.

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APPENDIX

Area: Mathematics

Goal: I. To Perform Mathematical Manipulations

Competency: 2. Measuring and Constructing

D.C.I. Number	Behavioral Indicators	Match Indicator	Art	English	Home Economics	Industrial Arts	Mathematics	Music	Physical Education	Science	Social Studies	Health	Guidance	Library Services	Reading
2.2.1	- Read scales	M					1		6-12	1-9 Bio	6-7 10				

Competency: 3. Collecting and/or Reading Data

2.3.1	- Use information from tables.	M				7	4		6-12	2-9 Bio	5-12	5			
2.3.2	- Use information from graphs.	M					2			2-9 Bio	5-12				

Area: Mathematics

Goal: II. To Understand Concepts and Processes

Competency: 1. Understanding Number and Numeration

D.C.I. Number	Behavioral Indicators	Match Indicator	Art	English	Home Economics	Industrial Arts	Mathematics	Music	Physical Education	Science	Social Studies	Health	Guidance	Library Services	Reading
3.1.1	- Write numbers in words and numerals.	M	1-8				1								
3.1.2	- Rename simple fractions as percents.	M					5			5					
3.1.3	- Rename percents as decimals.	M					5								

Competency: 2. Understanding Geometric Properties and Measurement

3.2.1	- Find perimeter and area.	M	6-8				5								
3.2.2	- Choose an appropriate unit	M	1-8				3								

Competency: 3. Understanding Properties and Processes of the Number System

3.3.1	- Order decimals.	M					5								

Area: Mathematics

Goal: III. To Solve Specific Mathematical Problems

Competency: 1. Solving and Checking

D.C.I. Number	Behavioral Indicators	Match Indicator	Art	English	Home Economics	Industrial Arts	Mathematics	Music	Physical Education	Science	Social Studies	Health	Guidance	Library Services	Reading
4.1.1	- Choose a reasonable answer	M					2			1-9 Bio					

Area: Mathematics

Goal: IV. To Use Mathematical Reasoning and Processes to Meet Personal and Societal Needs

Competency: 1. Solving Personal/Societal Problems

D.C.I. Number	Behavioral Indicators	Match Indicator	Art	English	Home Economics	Industrial Arts	Mathematics	Music	Physical Education	Science	Social Studies	Health	Guidance	Library Services	Reading
5.1.1	Find the average of a set of whole numbers.	M					4		6-12	5-6					
5.1.2	Solve problems - add and subtract money problems.	M					1								
5.1.3	Solve problems - multiply and divide money problems.	M					5								
5.1.4	Solve problems - find a whole number percent of a number.	M					6		6-10						
5.1.5	Make change.	M					5								
5.1.6	Find elapsed time.	M					3			1-6					

Baltimore County Public Schools June 1982

PROJECT BASIC

Master Curriculum/Competency Match

Area: Reading

Goal: IV. Meet The Reading Demands For Functioning In Society .

Competency: 1. Following Directions

D.C.I. Number	Behavioral Indicators	Match Indicator	Art	English	Home Economics	Industrial Arts	Mathematics	Music	Physical Education	Science	Social Studies	Health	Guidance	Library Services	Reading
1.1.0.1	- Interpret basic directional-type vocabulary from road signs needed for walking.	M		1-6							2				3-6
1.1.0.2	- Interpret basic directional-type vocabulary from signs located in and on buildings.	M		1-6							2				3-6
1.1.0.3	- Interpret basic directional-type vocabulary from textbook instructions.	M	1-8	1-6	7					7-9 Bio	7,11				3-6
1.2.0.1	- Follow directions written in sequential order to know what to do in case of an emergency.	M		1-6		7				2					4-6
1.2.0.3	- Follow directions written in sequential order to play a game.	M		1-6		7		K-6		2					4-6
1.3.0.1	- Interpret caution and warning signs to know how to protect themselves and others from injury or inconvenience.	M	K-8	1-6	7	7			1-12	3-6 7-9 Bio	2				3-6
1.3.0.2	- Interpret labels on packages and containers to know how to protect themselves and others from injury or inconvenience.	M	4-8	1-6		7				7-9 Bio	9	3,5			4-5

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