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A validity assessment of a mathematics placement test used with entering students at Mott Community College

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Wayne State University, 1991
A VALIDITY ASSESSMENT OF A MATHEMATICS PLACEMENT TEST
USED WITH ENTERING STUDENTS AT MOTT COMMUNITY COLLEGE

by

EULA M. SPANN-KIRK

A DISSERTATION

Submitted to the Graduate School
of Wayne State University
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in partial fulfillment of the requirements
for the degree of

DOCTOR OF EDUCATION

1991

MAJOR: Curriculum and
Instruction

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Date

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DEDICATION

This work is dedicated to my mother, Hattie Lane-Spann
and my granddaughter, Akosua Brent-Kirk
ACKNOWLEDGEMENTS

I wish to thank Dr. Donald Marcotte for agreeing to serve as major advisor for my dissertation, Dr. Rodolfo Martinez and Dr. Maurice White for being so generous with their time and encouragement, and Dr. Leonard Kaplan for his kind words and encouragement.

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There are always those who stand by me regardless of what new adventures I come up with, they give their emotional support and encouragement, for me this had been my family. A special warm loving thanks to my two sons, James and Juan, my sisters, Elease Williams and Linda Cloyd, and my brothers, Richard, Williams and Thomas Spann.

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To all my family and friends, thanks for being there for me, I am truly grateful.
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Chapter I

INTRODUCTION

Before fall semester 1985, all First Time In Any College (FTIAC) entering students at Mott Community College (MCC) were required to complete a battery of placement tests. Test results, along with previous academic records, student goals and self assessment, and counselor/advisor assessments are used to guide students into coursework at their level of competence. Once courses have been selected, additional assessment is completed during the first week of basic skill coursework (i.e. developmental mathematics).

Students who have been improperly placed initially may be transferred to a higher or lower level course, depending on the results of the second assessment. Thus, the chance for error in course placement is minimized. Through the normal process of testing, when a student enters the college, all placement in courses is the result of the academic assessment practices noted above, which are non-mandatory. MCC was included in a study conducted in 1988 that related to remedial/developmental programs in Michigan's 29 community colleges. Of these colleges, 72% of the colleges indicated that they required testing of all newly admitted students, though 86% said that testing could be waived; nearly 45% of the colleges had mandatory placement in mathematics.

The phrase "developmental/remedial education or programs" is used in postsecondary education to describe programs that teach academically underprepared students in skills they need to be more successful learners. The term includes, but is not limited to, remedial
courses. Whether these students are recent high school graduates with inadequate basic skills, returning adults with dormant skills, or undecided students with low motivation for academic achievement, developmental/remedial programs can provide them with the appropriate academic tools for success. It is extremely important at MCC to look at the students and evaluate their needs in order to ensure their success. Effective developmental/remedial education programs provide educational experiences appropriate to each student's level of ability, ensure standards of academic excellence, and build the academic and personal skills necessary to succeed in subsequent courses and on the job.

A survey of students' assessment and developmental education in Michigan's public community colleges (1990) concluded that developmental/remedial programs are comprehensive in that they assess and address the variables necessary to each level of the learning continuum. They employ basic skill courses, learning assistance centers, supplemental instruction, paired courses and counseling services. There are differences in developmental/remedial classes as they are taught in high school and in college. The major difference between developmental/remedial courses at the college-level seems to be in the pattern of presentation: (laboratory versus classroom and in the staffing) a lead instructor supervising a corps of aides versus a lone instructor in a classroom (Cohen, 1985). At MCC, all developmental/remedial coursework is taught by regular full-time faculty members who have selected the assignment because of their interest and skills in teaching developmental/remedial students. Developmental classes may count
as credit toward graduation (maximum of 12 credits), are graded as pass(S)/fail/(U) and do not carry honor points, and have a reduced class size so that most instruction can be individualized.

Research concedes that an entrance examination or placement test can be better used as a diagnostic tool to assess students' basic skills levels only if the necessary support for instruction of these basic skill accompanies their use (Benjamin, 1991). At MCC, in addition to the instructional practices listed above, peer tutors are available for tutoring support and students who require special needs are provided with professional tutors, staff assistant support, and interpreters, if needed.

For the Winter, 1989, an innovative program of computer assisted instruction (WICAT) to supplement remedial/developmental was proposed at MCC. WICAT is a Computer Aided Instruction (CAI) tutorial system. In 1990, MCC undertook a project to determine the viability of this system for students in remedial-development classes (reading, English, and mathematics). The study was compared to performances of students in traditional instruction developmental classes. The mathematics instructions offered on WICAT range from level 0 all the way to geometry and trigonometry. The lab operates both on a drop-in basis and as an auxiliary classroom where teachers bring their classes for supplementary classroom exercises. The system also provides tutorial services so that students who need extra help can receive it. Results showed significant increases for those students enrolled in the WICAT sections of all classes (Appendix A).
Although research indicates that random self-placement of students into classes is not a sound policy (Cox, 1985), fall semester, 1985 Mott College decided to let 239 FTIAC students into the college without taking the mathematics placement test. The students were advised to take the mathematics placement test before they registered for classes the following semester. While the students saw a counselor/advisor, the counselor/advisor was not able to advise them on the appropriate mathematics class based upon a score. Using their high school grades in mathematics and their reading of the description of MCC's mathematics classes, the students registered for the class they thought they were most qualified to take.

The area of health care, science, and engineering requires mathematics classes. For millions of people, community college education represents the last real opportunity to develop an interest in science, mathematics, or engineering and to develop the prerequisite skills for a career in these fields (Parilla, 1990). Research indicates that careers for the 90's will require students to have mathematics classes for fields that will hire the most people, such as in health care, service positions, and computer science. MCC must determine if it is properly placing students in mathematics classes and if by testing students we can ensure their success in their mathematics classes.

Research indicates that if students are tested, the institution should be prepared to deal with the results of the test. If needed, students should be provided with support services necessary to help them successfully complete their classes. The question is, then, does
proper class advising, using placement tests, help provide for this success?

Research on performance of St. Petersburg Junior College students in June and October 1989 states that students who wait several terms after being tested to begin their mathematics study have a lower success rate in the recommended courses than those who begin their study immediately after assessment or only one semester later. It shows that 69% of the students who take mathematics placement tests enrolled in a mathematics class with no delay. Of these, 62% enrolled in the class recommended, 36% enrolled in a higher-level class, and approximately 2% enrolled in a class other than that recommended.

A review of the mathematics assessment of Saddleback College students through the matriculation program also shows that 1,336 out of 2,354 students enrolled in a mathematics class within three terms from the time they were tested. Almost all (94%) of those who participated in the mathematics assessment process enrolled in courses in the college district, and slightly less than two-thirds of those who enrolled took a mathematics class within three terms following completion of the assessment process. Nearly two-thirds of those who enrolled in a mathematics class chose the course recommended by the assessment/advisement process of the matriculation program. Students who followed the course placement recommendation successfully completed those courses at a much higher rate than students who placed themselves above their recommended level (Sworder, 1990).
Research was conducted by Conlin to determine what happens to students who by-passed the remedial classes for which they had been recommended. By-passing remedial mathematics seemed to have had a devastating effect on later attempts to pass curriculum-level mathematics, with 90% of those students who skipped remedial mathematics either failing or withdrawing from attempted mathematics courses (Conlin, 1989).

MOTT COMMUNITY COLLEGE

Mott Community College (MCC) opened its doors in 1923 with 114 students enrolled in the traditional single curriculum liberal arts. The purpose of the college now is to provide a wide variety of learning opportunities for adults, regardless of age or background, in Genesee County and surrounding areas. Serving all who desire to identify and develop their abilities and interests, the college seeks to eliminate barriers to education and to enhance both individual growth and community development.

MCC accomplishes these purposes, both on campus and in the community, by providing college transfer courses, other general education courses, technical and vocational training, developmental education, continuing education, and diverse community services, as well as vital support services, such as guidance and counseling, a library, a media center and others services which augment the educational offerings. MCC is fully accredited by the North Central Association of Colleges. Through its educational programs and services, one may acquire an Associate Degree in Arts, Science,
General Education or Applied Science; or Certificates of Achievement in vocational-technical programs and selected arts and science programs. Students also acquire course credit that is either transferable to other post-secondary institutions or that are developmental in nature. Further learning experiences are provided for the service area through community and non-degree continuing education programs, and individual programs are accredited by specialized accrediting agencies and professional organizations.

There were 2,317 First Time In Any College (FTIAC) students admitted to MCC in fall semester 1985. This represents an average fall enrollment; however, the number may fluctuate by five percent based upon whether General Motors is in full operation or whether it is experiencing layoffs. During the time when General Motors has a large layoff, MCC experiences an increase in enrollment. At the time, General Motors was operating at nearly full capacity.

Students entering MCC have over 55 different programs from which they can either receive a degree or a certificate. These programs range from a one-year certificate in typing to a two-year degree in pre-engineering, pre-medicine, pre-dental, and others. Twenty-five to 33% of the graduates from MCC transfer to a four-year college.

In trying to meet the need of the college students in the 80's, MCC opened its doors for the first time for students to take classes without taking the mathematics placement test. This was a one time admission of such students. This study focused on a comparison of these students and an equal number of randomly selected students
who entered the college at the same time and took the placement test.

THE MATHEMATICS PLACEMENT TEST

Before Fall Semester, 1985, a mathematics placement test was given to all FTIAC students entering MCC. The college uses an in-house developed test to evaluate the mathematics level of its incoming FTIAC students. Research indicates that the development of basic skills placement tests by local faculty is widespread. The writing of mathematics problems appears to be relatively easy, while the development of other placement tests may lie beyond the capabilities of most local groups of faculty (Morante, 1987). This consensus masks a deeper problem. While the writing of items or questions appears to be relatively simple for some, especially for those who have taught for many years, the writing of good, unambiguous items that discriminate well among students of different groups, that are unbiased, and that relate well to the total test score is much more complex than it appears to be on the surface. In addition, the combination of items to form a comprehensive test that is both reliable and valid is very difficult to accomplish without a process of pretesting, statistical analysis, and objective, professional review. The biggest complaint that the faculty makes against standardized tests seems to be that such tests do not measure what they want students to know or that the tests do not measure what the faculty teaches (Morante, 1987).

One of the decisions that must be made and periodically reassessed is whether to create a test locally (a so-called "in-house"
or departmental test) or purchase an externally developed test (referred to as a standardized test). According to a 1986 study of developmental mathematics courses (McDonald, 1988), the primary tool used for placement purposes is a departmentally-developed placement test.

There are positive and negative features about a department test that should be considered in deciding whether to create or continue using an in-house assessment tool. One advantage of the departmental test is that the local control of its content may make the test more closely referenced to unique institutional and departmental needs. Developing and validating a local instrument allows faculty to examine their curriculum and to share criteria for assessing students. Assessing mathematics skills requires a great deal of thought on the part of mathematics faculty. Designing or selecting the appropriate instruments that measured the full range of student competencies at several levels is not easy (Ahrendt, 1987).

After much thought, MCC decided to develop its mathematics placement test in-house. The intent of this test was to assist students in selecting the correct level of mathematics at which to begin college. It is important that students do not take a class that is too difficult or too easy so that they do not become discouraged or overconfident.

The test was developed by one of the college's former mathematics instructors, and test was last revised in 1977. At the time the test was revised it was not validated. It consists of thirty multiple choice questions that are recorded on a scannable sheet. The
questions range from basic arithmetic through intermediate algebra. For a layout and directions for the test, see Appendix B.

MCC has an open door policy which states that any student that has either graduated from high school and/or is 19 years of age can take college credit classes. High school students may also take classes, but they must have the permission of their high school counselor, principal and parent. Although these students are/were permitted to take classes at MCC, the college, up to Fall Semester 1985, required that all FTIAC students take the mathematics placement test before they take a mathematics class.

Based upon the score received on the mathematics placement test, students are strongly advised to take the recommended mathematics class. Because MCC does not have mandatory placement, students are only advised to take a class. Research supports the idea that students who follow the course placement recommended successfully complete these courses at a much higher rate than students who place themselves above their recommended level (Sworder, 1990).

Cox (1985) states the conditions under which college administrator can ensure success in an open-access college is to not only have a mathematics placement test, but also should have mandatory assessment and placement in the appropriate mathematics class/ies.

In a 1990 survey of student assessment and developmental education in Michigan's public community colleges, a study of community colleges in Michigan concludes that community colleges are at a critical crossroad in developmental education. Although all
community colleges in Michigan academically assess students, fewer than one-half require student placement in tested content areas of deficiency (e.g., mathematics). Additionally, only 15 community colleges (52%) require students to pass developmental courses as a precondition to enrollment in college-level coursework.

STATEMENT OF PROBLEM

This research study will determine if the mathematics placement test at MCC is a valid predictor of student success in mathematics. The study is designed to answer the following questions:

1. Did the students who took the mathematics placement test take the advised mathematics class?
2. Does the mathematics placement test taken before entrance to MCC accurately place students in mathematics classes?
3. Is there a difference in final grades among students who took the mathematics placement test and took the recommended courses, who took the mathematics placement test and did not take recommended courses, and who did not take the mathematics placement test?
4. Does the mathematics placement test predict the students' overall academic achievement in mathematics?
5. Does successful placement of students in mathematics classes make a difference in the retention rate of students in mathematics classes?
The following hypothesis are used to answer the research questions:

**H0**: Students taking the mathematics placement test follow advised mathematics recommendation.

**H1**: Students taking the mathematics placement test do not follow advised mathematics recommendation.

**H0**: Mathematics placement tests currently place students in appropriate mathematics classes according to ability.

**H1**: Mathematics placement tests do not currently place students in appropriate mathematics classes according to ability.

**H0**: There will be no difference in the final grades among students who took mathematics placement tests and took the recommended course, those who took mathematics placement tests and did not take the recommended courses, and students who did not take mathematics placement tests.

**H1**: There will be a difference in the final grades among students who took mathematics placement tests and took the recommended course, those who took the mathematics placement tests and did not take the recommended courses, and students who did not take the mathematics placement tests.

**H0**: There will be no difference in mathematics grade point average of students completing mathematics placement test and those who do not complete the test.
H1: There will be a difference in mathematics grade point average of students completing mathematics placement test and those who do not complete the test.

H0: There will be no difference in the retention of those students who took the mathematics placement test and those students who did not.

H1: There will be a difference in the retention of those students who took the mathematics placement test and those students who did not.

PURPOSE OF THIS STUDY

The purpose of this study was to determine if the mathematics placement test at MCC is successfully placing students in the appropriate mathematics classes:

Since the selective admission of students is not an issue in the community college, entrance and achievement testing has often been used for placement purposes, rather than as a criterion for acceptance or rejection. Unfortunately, the use of standardized college entrance examinations has not proven to be effective devices for placing entering students into appropriate mathematics courses (Wattenbarger and Norman, 1989). The placement test at MCC was designed to properly place students into the correct classes and to ensure their successful completion of the class with a grade of "C" or better. Research indicates that once an institution implements the use of a placement test, it must periodically re-assess the test to
determine if it adequately measures what the institution want students to know.

The decision to continue using the currently used in-house placement test at MCC is based on student success. MCC needs to determine whether the students who did not take the mathematics placement test did as well or better in their mathematics classes as the students who took the mathematics placement test.

MCC states it has an open door policy which permits students who have graduated from high school, students who are over 19, or students in high school who have the permission of their principal, counselor and their parents, to take classes. MCC is also concerned about the open door policy that permits student to take a class, withdraw from the class because they are not doing well, or actually fail their class. Open door policy does not benefit a student unless the conditions under which student success can be ensured in open door colleges are defined. Retention of students must be considered if an institution plans to ensure student success. While the retention rate at MCC is 69%, the college feels that somehow it has be able to reach the 31% they are losing.

There are many traditional ways community colleges have measured retention rates of their students. MCC has chosen to look at students who did or did not take the mathematics placement test. By re-assessing the mathematics placement test at MCC, the college will determine if the students who took the mathematics placement were still enrolled in classes after four continuous semesters.
DEFINITION OF TERMS AND ACRONYMS

Academic Achievement - The actual composite grade received by students in mathematics classes.

Mathematics Placement - All first-time college students entering Mott Community College have to take a mathematics placement test to determine their level of proficiency. They are placed in mathematics classes based upon their placement scores.

Mathematics placement test - An in-house test developed by a former faculty member at MCC to place students into the appropriate mathematics classes.

Students who did not take the mathematics placement test - Students who were allowed to register for classes after registration had officially closed. The students could register for any mathematics class they chose.

Students who took the mathematics placement test - Students who made application to Mott Community College early enough to complete their placement tests before school started. They were advised by an advisor or counselor, based on their scores, as to which mathematics class to take.
Honor Points - The numerical value assigned to a letter grade in order to provide a basis for quantitative determination of a grade point average; most common usage is A = 4, B = 3, C = 2, D = 1, and E or F = 0. The term honor point is sometime referred to as Quality Points.

FTIAC - First time student in any college (FTIAC).

LIMITATIONS OF THIS STUDY

This study was be limited to the following:
1) FTIAC students at MCC; returning or transfer students were not considered for inclusion in the study;
2) Mathematics classes taken by FTIAC students entering MCC fall semester, 1985;
3) Students who were FTIAC in Fall Semester, 1985 who did not take the mathematics placement test.
CHAPTER II

REVIEW OF LITERATURE

A review of the relevant literature dealt with major publications on mathematics placement tests, student placement in recommended mathematics classes, self placement in mathematics classes, mandatory placement and recommended classes, remedial/developmental mathematics classes in community colleges and student success in future mathematics classes. Looking at the community colleges, it is apparent that for millions of students, two-year college education represents the last real opportunity to develop an interest in science, mathematics, or engineering and to develop the prerequisite skills for a career in these fields (Parilla, 1989).

A review of the literature concludes that while no community college requires an examination prior to admission, 52% require an examination prior to registration (Rivera, 1981). In a survey of student assessment and developmental education in Michigan's public community colleges, the research states that community colleges are at a critical crossroad in developmental education. Although all community colleges in Michigan academically assess students, less than one-half require student placement in tested content areas of deficiency.

All entering students at Mott Community (MCC) are required to complete a battery of placement tests. Test results, along with previous academic records, student goals and self assessment, and
counselor/advisor assessments, are used to guide students into course work which is at their level of competence. Once courses have been selected, an additional assessment is completed during the first week of basic skill coursework (i.e. developmental math). Students who have been improperly placed initially may be transferred to a higher or lower level course depending on the results of the second assessment. By having two different assessments, the chance for error in course placement was minimized.

Benjamin (1991) concedes that entrance examinations can be better used as a diagnostic tool to assess students' basic skills level, but only if the necessary support for instruction of these basic skills accompanies this use. Research agrees that entrance examinations are important; however, they should be followed with the necessary support for instruction of basic skills. Since we have accepted the principle of open access in our community colleges, we must then look at the conditions under which we can ensure the success of our students. Cox (1985) stresses that with the acceptance of open access, there is a need for mandatory assessment and placement in appropriate mathematics courses; required enrollment in appropriate remedial courses; and specification of recommended competency skill levels for all courses. Cox (1985) further states that it is society's responsibility to provide open access to opportunities provided only through postsecondary education. The monitoring of student success is a way of being responsible for student success. Through open access and student success, this can be done in all community colleges.
Before we get into the issue of what to do with students after we have tested them, we need to decide what type of placement tests is available for entering students. Research indicates that there are two possible mathematics placement tests available for students entering into community colleges. They are in-house tests and standardized tests. At Mott Community College (MCC), we use an in-house test.

Ahrendt (1987) states that one of the decisions that must be made and periodically reassessed is whether or not to create a test locally or purchase an externally developed test. According to a 1986 study of developmental mathematics courses (Donald, 1988), the primary tool for placement purposes is a departmentally-developed placement test. There are positive and negative features about a department test that should be considered in deciding whether or not to purchase an externally developed test or continue using an in-house tool. One advantage of the departmental test is that the local control of its content may make the test more closely referenced to unique institutional and departmental needs (Bray, Morante, 1987).

Bray (1987) states that assessing mathematics skill requires a great deal of thoughtfulness on the part of mathematics faculty. She also states that designing the appropriate instrument to measure the full range of student competencies at several levels is not easy. On the other hand, Marante (1987) indicates that the development of basic skills placement test by local faculty is widespread. He also states the writing of mathematics problems appears to be relatively easy. However, the consensus masks a deeper problem. While
writing items or questions appears to be relatively simple for some, especially for those who have taught for many years, the writing of good, unambiguous items that discriminate well among students of different groups, that are unbiased, and that relate well to the total test score is much more complex than it appears to be on the surface.

Research supports open access/door policies and mathematics placement tests for community colleges. However, this research points to the support that community colleges must provide to the students they have tested. Cox (1985) states that it is the responsibility of the community colleges to provide developmental/remediation to prepare their students to succeed in degree and certificates programs. This responsibility is to people who must have an opportunity for changing their economic and social status through postsecondary education.

A survey of student assessment and developmental education in Michigan's public community colleges defines the term developmental education, as used in postsecondary education, as programs that teach academically underprepared students the skills they need to be more successful learners. The term includes, but is not limited to, remedial courses. These students are recent high school graduates with inadequate basic skills, returning adults with dormant study skill, or undecided students with low motivation for academic achievement, developmental programs can provide the appropriate academic tools for success.

Effective developmental education programs provide educational experiences appropriate to each student's level of ability, ensure standards of academic excellence, and build the academic and
personal skills necessary to succeed in subsequent courses on the job. Developmental programs are comprehensive in that they assess and address the variables necessary to each level of the learning continuum. They employ basic skill courses, learning assistance centers, supplemental instruction, paired courses, and counseling services. The difference between remedial and college-level mathematics courses, as defined by A.M. Cohen (1985), seems to be in the pattern of presentation (laboratory vs classroom) and in the staffing (a lead instructor supervising a corps of aides vs a lone instructor in a classroom).

Argumedo (1989) states that all developmental coursework at MCC is taught by regular, full-time faculty members who have selected the assignment because of their interest and skills in teaching developmental students. Developmental classes at MCC may count as credit toward graduation, are graded as Pass(s)/fail(u) and do not carry honor points. In addition to the instructional practices listed above, peer tutors are available for tutoring support and students who meet special needs qualifications are provided with professional tutors. Staff assistant support, and interpreters, if needed, are also provided.

Cox (1985) maintains that for many of the students entering college for the first time, basic skill courses are not remedial. This is the first time exposure to new learning. This new learning only has meaning when the students can apply the mathematics skill to their degree and certificate program. While 72% of the colleges in Michigan require placement tests for all of their entering students, only 34% have mandatory placement in mathematics (Argumedo,
1989). The conditions under which student success can be ensured in open access colleges is for mandatory assessment and placement in appropriate mathematics classes Cox (1985).

Research by Richards (1986) shows that students who follow the advice given to them by counselors regarding mathematics courses placement tend to succeed to a significantly higher degree than those who do not. Among the students who followed the counselors' advice at Colorado Community College, 64% succeeded in developmental mathematics, and 76% succeeded in college mathematics. Of the total number of cases examined, 73% followed counselors' advice and succeeded in the recommended courses. Only 15% followed counselors' advice, but did not succeed. Furthermore, 5.9% did not follow counselors' advice, and did not succeed, while 6.5% did not follow counselors' advice, but succeeded anyway. Seventy-eight percent of the students re-enrolled the following semester. Based on his study findings, it was concluded that the current new-student assessment and advising program was effective.

A study by Johnson (1985) concluded that students who followed the advice of their counselors had higher success rate than students who did not. Along similar lines, Miller (1982) did a study over a two-year period, and his study revealed that the 82 students who entered the developmental program as recommended by their counselors achieved higher rates of academic success, as judged by grade point average, credit hours attempted and completed, and academic persistence, than the 202 students who enrolled directly in regular academic programs.
In another study, Charry (1983) investigated the effects on students' success of the early completion of remedial mathematics courses; enrollment in advanced courses before the completion of 25 credits; the number of credits attempted during the first three semesters; or the interaction of these elements with each other and with curricular assignment. Data were collected on 198 students who first registered in 1978. Of these, 99 had been placed on academic probation and 99 would graduate by 1981. The study revealed that the 1981 graduates had completed remedial courses on an average of at least one semester earlier than students on probation.

Cox (1985) states that random self-placement of students into classes is not a sound policy. Assessment, placement and follow-up increases the institution's ability to respond effectively to students. Student success can be ensured by not allowing a student to randomly self-place but by stressing the need for mandatory assessment and placement in appropriate remedial courses the first semester of registration.

The Student Assessment Task Force Report of the Washington State Student Service Commission reveals that the percentage of community college students entering the system with basic skill deficiencies in mathematics is 53% to 85%. In Michigan, a survey of student assessment and developmental education in Michigan's public community colleges data shows that although all community colleges in Michigan academically assess students, less than one-half require students placement in tested content areas of deficiency (e.g., mathematics). Additionally, only 15 community colleges (52%)
require students to pass developmental courses as a precondition to enrollment in college-level coursework.

A study conducted by Conlin (1989) states that for the students who bypassed mathematics classes, there seems to be a devastating effect on later attempts to pass curriculum-level mathematics. It showed that 90% of the students skipping remedial mathematics either fail or withdraw from attempted mathematics courses. Cox (1985) states that the timing is important for students in enrolling in their first mathematics class after completing the mathematics placement test. She states students should be required to enroll in the appropriate remedial course the first semester of registration.

Sworder (1990) conducted a study on the delay of entry into the mathematics curriculum following completion of the matriculation process. He found that 68.7% of the students enrolled in a mathematics class with no delay. Sixty-two percent enrolled in the class recommended, 36% enrolled in a higher-level course, and approximately 2% enrolled in a course lower than that recommended. Their data did not support the hypothesis that students who waited several terms to begin their mathematics study had a lower success rate in the recommended courses than those who began their study immediately after assessment or only one semester later.

However, only 20% of the community college students enrolled in a given science, mathematics, or engineering course plan to pursue a bachelor's degree in those areas. Many students enroll in careers that require science, mathematics, or engineering majors, but soon lose their interest and switch majors or become frustrated by the lack of preparation needed for success in mathematics and science.
courses. In 1990, a survey of student assessment and developmental education in Michigan's public community colleges found that in fall 1988, 10,801 students had test scores indicating that they needed developmental work in mathematics computation and 7,638 needed developmental work in algebra. There were actually 8,946 students in Michigan's public community colleges enrolled in mathematics computation classes and 5,925 enrolled in algebra classes.

Sworder (1990) studied 1,226 student enrolled in a mathematics class at Saddleback College for three terms. He found that almost all (94%) of those who participated in mathematics assessment process enrolled in courses in the district, and slightly less than two-thirds of those who enrolled took a mathematics class within three terms following completion of the assessment process. Nearly two-thirds of those who enrolled in a mathematics class chose the course recommended by the assessment/adviseement process of the matriculation program. He also found that students who followed the course placement recommendation successfully completed those courses at a much higher rate than students who placed themselves above their recommendation.

Research conducted by Richards (1986) at Colorado Community College shows that students who follow the advice given to them by counselors regarding mathematics course placement tend to succeed to a significantly higher degree than those who do not. Sworder (1986) conducted a study where he divided a group of students into two halves. The program group consisted of students who took assessment tests and followed placement recommendations, while the control group was made up of students who failed to attend
testing sessions and those tested students who placed themselves contrary to the counselor's recommendation. Moreover, program group members had higher success rates in mathematics courses than the control group members. The study found no correlation between placement instrument scores and final course grade in mathematics classes that were given placement instruments as class exercises.

Research conducted by Stonehocker (1985) at Grande Prairie Regional College assessed skill levels of entering freshman in the area of mathematics to identify the students' problems (i.e. student failure, lack of support and remedial material for college students with skill deficiencies, and lack of support for high risk students). The purpose of this study was to provide the institution with the cost and staff requirements of the recommended skill center.

Johnson (1985) conducted research on success rate comparisons for DeKalb Tech developmental studies students. He found, in mathematics courses, students who met testing requirements and entered their programs had higher success rates than developmental studies students.

Friedlander (1984) evaluated the Napa Valley College's Student Orientation, Assessment, Advisement and Retention (SOAAR) program. His research was on 866 students who were first-time students in mathematics. His research indicates that SOAAR students were less likely to complete their developmental courses in mathematics: to finish their introductory-level courses, and earn a grade of "C" or higher in their developmental or regular classes. It was concluded that test scores were not accurate predictors of
student success and that the SOAAR did not seem to increase student use of support services.

A study conducted in California's public colleges used a desirability of comprehensive entry-level testing program for mathematics students. The test results were used for counseling and placement. They saw remediation as a problem that faced all nationalities of students, not just minority students (Coffey, 1983). Another project was conducted at Cumberland County College to determine whether remediation of basic skills deficiencies has an effect on the successful completion of selected vocational courses. A placement test was given to determine the level of basic skills competencies in mathematics. The study found that grades were higher for students not needing remediation, compared with those who did need remediation, pointing to the need for students requiring remediation to be identified and advised to enroll in appropriate courses levels. The study also found that skill levels needed for various courses were higher than basic skills, emphasizing the need to enforce college policies calling for skill upgrading prior to entry into courses requiring a specific skill level. Finally, entry-level basic competencies for selected vocational courses were established and appropriate course sequences for remedial and vocational preparation were set (Miller, 1982).

Furthermore, Basonic (1982) conducted a study on the academic performance and persistence pattern of a select group of developmental students at Harrisburg Area Community College. Data were gathered from the computer-searchable records of 164 developmental students, as well as questionnaires completed by
students in 47 mathematics courses. Of those who did complete the sequence, 43% later completed a college-level mathematics course. The first semester grade point average was found to be a good predictor of success in completing the developmental sequence. By Spring of 1981, only four of the 164 students had attained a degree.

General Education: In The Changing Environment at Sante Fe Community College (Sullins, 1982) research indicates that advanced learning skills in mathematics are the stepping stones to future student success. A further study conducted by Sanchez and Betkouski (1986) on the factors affecting student performance in community college general chemistry courses found that high risk students in college chemistry are often identified by low mathematics SAT scores. They also found that successful students in introductory chemistry were older and had a better grasp of science process skills and good algebra grades.

Georgakakos (1990) did a study on the prediction of success and grades in political science and history. He found that mathematics test scores might be an effective predictor of grades for certain non-mathematics courses, such as history.
CHAPTER III

METHODOLOGY

This chapter discusses the methodology used to answer the research questions. It includes the design, variables, setting, population, sample, instrumentation, data collection procedures and data analysis.

DESIGN OF STUDY

The design used for this study was a non-experimental, causal comparative analysis investigating the differences between two groups of students. The first group was FTIAC students that entered MCC Fall Semester, 1985 who took the mathematics placement test. The second group was FTIAC students who entered MCC Fall Semester, 1985 and did not take the mathematics placement test. At this time the decision was made to allow students to enter MCC without taking the traditional mathematics placement test; these students were flagged by the computer. A subsequent study was done on these students to see how they performed in their classes.

The students who took the mathematics placement test, for the purpose of the study, were considered the comparison group. These students had been selected from the MCC data base of FTIAC students entering the college Fall Semester, 1985. The students who did not take the mathematics placement test, for the purpose of this study, were the focus group. There were 239 students from the focus group who were permitted to take classes without taking the
mathematics placement test. However, they were advised to take
the placement test before they registered for classes the following
semester. Up until Fall Semester, 1985, students were not permitted
to take mathematics classes until they took the placement test. Two
hundred thirty-nine students did not take the placement test; they
were compared with 239 students who did take the placement test.
A random-number program was used with the computer to generate
a list of 239 students who met the criteria of having taken the
placement test.

The following research questions and hypotheses were
addressed by the researcher.

1. Did the students who took the mathematics placement test take
the advised mathematics class?

2. Does the mathematics placement test taken before entrance to
MCC accurately place students in mathematics classes?

3. Is there a difference in the final grades among students who
took the mathematics placement test and took the
recommended courses, who took the mathematics placement
test and did not take recommended courses, and who did not
take the mathematics placement test?

4. Does the Mathematics placement test predict the students' overall academic achievement in mathematics?

5. Does successful placement of students in mathematics classes make a difference in the retention rate of students in mathematic classes?

The following hypotheses were used to answer the research questions:
H0: Students taking the mathematics placement test follow advised mathematics recommendation.

H1: Students taking the mathematics placement test do not follow advised mathematics recommendation.

H0: Mathematics placement tests currently place students in appropriate mathematics classes according to ability.

H1: Mathematics placement test do not currently place students in appropriate mathematics classes according to ability.

H0: There will be no difference in the final grades among students who took mathematics placement tests and took the recommended course, those who took mathematics placement tests and did not take the recommended course, and students who did not take mathematics placement tests.

H1: There will be a difference in the final grades among students who took mathematics placement tests and took the recommended course, those who took mathematics placement tests and did not take recommended courses, and students who did not take mathematics placement tests.

H0: There will be no difference in mathematics grade point average of students completing mathematics placement tests and those who do not complete the tests.

H1: There will be a difference in mathematics grade point average of students completing mathematics placement tests and those who do not complete the tests.
Ho: There will be no difference in the retention of those students who took mathematics placement tests and those students who did not.

H1: There will be a difference in the retention of those students who took mathematics placement tests and those students who did not.

INDEPENDENT VARIABLES

In order to test the hypotheses, the following independent variable was used: students who took and students who did not take the mathematics placement test, along with retention data for Fall and Winter Semesters 1985 and 1986.

DEPENDENT VARIABLES

The dependent variables being studied included grade outcomes based on advisement procedures. Grades received above "C" were considered as having met academic achievement. Grades lower than "C" were considered as not meeting academic achievement. The second dependent variable was the time, in semesters, a student waited before taking his first mathematics class. The retention rate of four semesters was used to determine how long a student stayed at MCC.
SETTING FOR STUDY

Mott Community College (MCC) is 68 years old and is located in Flint, Michigan, approximately 75 miles north of Detroit. In its 68 years, MCC has gone from an extension of the K-12 school system as Flint Junior College to Genesee Community College to its current name. We currently have two campuses with eleven buildings. Eight of the buildings are located on the same ground, and three buildings are located downtown (within three miles of the main campus). Our enrollment varies from 9,000 to over 11,000 students, in the fall and winter. Unfortunately, our enrollment is tied to the General Motors plants, in that when they have a lay-off, we usually see an increase in our enrollment.

Students are recruited for MCC through (1) advertisement; (2) the admission director visiting high schools; (3) high school counselors' recommendation; (4) high school data bases transferred to MCC via computer tape; (5) recommendation from former students, family, and friends, and (6) through our continuing education department. Students that are transferred to MCC's computer via tape are sent an application for admission. Once these students and all other students have submitted an application to MCC, they are notified by mail of the scheduled placement tests. Placement test dates are scheduled by the computer and the dates automatically mailed to the students.

When students have completed the placement tests, they are scheduled for orientation by the computer. At orientation, the students are given an overview of the college. They are taken on a
tour of the college facilities (registrar's office, counseling, college store, etc). At orientation, if a student has identified a major, he is given the name of a counselor to see. Otherwise, counselors are on hand to help undecided students. Students who have chosen a major are directed to set up an appointment with their advisor. At the meeting between the student and the advisor, the student reviews the recommended mathematics classes based on the students' placement test scores. Since mandatory placement is not currently in effect at MCC, it is strongly advised that the student take only the recommended class/es.

The 1990 breakdown of student, faculty and staff at MCC is as follows: the average age of the students enrolled at MCC in 1990 is 29.5, with a standard deviation of 9.17. There are 63% female and 37% male students enrolled, 81.5% are white, 14% black, 3% Hispanic, 1.5% others, and less than 1% foreign students. An ethnic and sex breakdown of student enrollment is shown in Table 1.
Table 1
Winter 1990 -91
Ethnicity of students
Table of Sex by Ethnic

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>American Indian</th>
<th>American Asian</th>
<th>Hispanic</th>
<th>White</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1040</td>
<td>77</td>
<td>36</td>
<td>107</td>
<td>4735</td>
<td>9</td>
</tr>
<tr>
<td>Male</td>
<td>486</td>
<td>46</td>
<td>28</td>
<td>79</td>
<td>3340</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>1526</td>
<td>124</td>
<td>64</td>
<td>186</td>
<td>8075</td>
<td>15</td>
</tr>
<tr>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

The faculty consists of 181 full-time, and 180 part-time. There are 454 other supporting staff members.

POPULATION OF STUDY

The population for this study included all of the 239 FTIAC students who entered MCC in Fall Semester, 1985, who did not take the mathematics placement test. These students were allowed to register for classes after the official deadline for registration had closed. These students did not have time to complete the mathematics placement test before classes started. Therefore, students were not able to meet with a counselor to determine the appropriate class for them to take.
SAMPLE OF STUDY

A random sample of 239 FTIAC students was matched against the FTIAC students who entered MCC Fall Semester, 1985, who took the mathematics placement test. A random generation software package was used on a Prime 9955 computer to generate students who took placement tests. These students met with an advisor/counselor to determine which class they should take. The sample consisted of all students admitted without taking a mathematics placement test. A second group, used for comparison purposes, was drawn from the general population of students using a random number generator program and student enrollment lists for the same semester.

Instrumentation

A data gathering tool was developed to collect information from student records. The instrument included personal learner characteristics, age, gender, and ethnic background. Information regarding placement testing, course achievement, course selection, grades in each mathematics class, and retention records were analyzed. No personal contact was made between researcher and students selected for the study. The researcher maintained confidentiality of student records and destroyed all identifying information following data analyses.
DATA COLLECTION

SQL programs using a Prime 6650 Computer and a ShareBase 500 relational database machine were written to select pertinent data from the student's record (see Appendix C). Data on the students were selected using a Prime 6650 computer. The researcher was responsible for writing, testing, and running all the programs, and gathering all the data. No students assisted with the collection of data or the execution of programs.

DATA ANALYSIS

All alphanumeric data was converted to numeric data. The SPSS-PC+ (version 4.0) was used to make calculations (see Appendix D). SPSS -PC+ was used to perform 1) t-tests between students who took the mathematics placement test and students who did not take the mathematics placement test on composite mathematics grade point averages. 2) Chi square was used to determine retention rate based on the number of consecutive semester for both the students who did and did not take the mathematics placement test. 3) Kruskal-Wallis was used to test the significance of the final grade of students by group membership.
CHAPTER IV

Results and Discussion

The purpose of this chapter is to report the analysis of the data on students entering Mott Community College (MCC) in fall semester, 1985, who did not take the required placement exams and compare their success and retention data against students who did take the placement tests. For the purpose of this study, the records on mathematics courses are being used to compare the two groups.

The subjects for this study were students who entered MCC in Fall Semester, 1985, without taking required mathematics placement tests matched with a group of students who did take these tests. Prior to Fall Semester, 1985, all First Time In Any College (FTIAC) students at MCC were required to complete a battery of placement tests before taking any classes. MCC did not allow enough time for this testing for the Fall Semester, 1985, prior to classes starting, and 239 students were not tested. The students were advised to take placement tests at some time during the semester prior to enrolling in Winter Semester, 1986, classes.

Data were gathered from student records in order to complete the comparisons. According to the Equal Opportunity Act, students were not required to provide any demographic information, but may do so on a voluntary basis for record keeping and statistical purpose. As a result, the only information available on all students was age, ethnicity, and gender. This information was presented in the form of
crosstabulations to provide background information on the personal characteristics of the students.

The students at MCC were drawn from all age groups, with the younger students coming from local high schools and older students enrolling either to train for a new profession or to obtain enrichment. The result of the analysis of the students' ages is found in Table 2.

Table 2
Age of Student by Group Membership

<table>
<thead>
<tr>
<th>Age of Student</th>
<th>Not Tested</th>
<th>Tested</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 &amp; Younger</td>
<td>46</td>
<td>92</td>
<td>138</td>
</tr>
<tr>
<td>27-36</td>
<td>5</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>37 and Older</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td><strong>106</strong></td>
<td><strong>159</strong></td>
</tr>
</tbody>
</table>

The ages of the students ranged from 17 to 46 years of age. For the purpose of this study, they will be categorized into three groups. The youngest group was students 27 years of age and younger, 86.8% of the sample (n=138). Of these 138 students, 46 had not taken mathematics placement tests and 92 had completed the tests prior to enrollment. There were 14 students (8.8%) between the ages of 28 and 37 at the time of first enrollment. Of these 14 students, five had not taken placement tests and nine had completed the testing. Seven students were over 37 when they enrolled as FTIAC's at MCC. Of these seven students, two had not taken the tests and five had completed the tests.

The gender of the students was available from the student records. The result of the student gender by group measurement is provided in Table 3.
Table 3

<table>
<thead>
<tr>
<th>Gender of Student</th>
<th>Not Tested</th>
<th>Tested</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>24</td>
<td>49</td>
<td>73</td>
</tr>
<tr>
<td>Male</td>
<td>57</td>
<td>29</td>
<td>86</td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>78</td>
<td>159</td>
</tr>
</tbody>
</table>

Of the 159 students included in the study, 73 were female and 86 were male. Twenty-four females and 57 males did not take the required placement tests in 1985, while 49 females and 29 males in the comparison group did take the placement tests.

The students' ethnic backgrounds were available on the student records. The results of this summarization of data are shown in Table 4.

Table 4

<table>
<thead>
<tr>
<th>Ethnicity of Student</th>
<th>Not Tested</th>
<th>Tested</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American</td>
<td>10</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>American Indian</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>American Asian</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Caucasian</td>
<td>40</td>
<td>84</td>
<td>124</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>106</td>
<td>159</td>
</tr>
</tbody>
</table>
The ethnicity of the students in the sample includes 23 African-Americans, of whom 10 did not take placement tests while 13 did complete them. Two American Indians took the test, as did the five Hispanics. Three of the five American Asians in the study did not take the tests, along with 40 of the Caucasian students.

Research question 1, "Did the students who took the mathematics placement test take the advised mathematics class?" was answered by testing Research Hypothesis 1, "Students taking the mathematics placement test follow advised mathematics class." In order to test the hypothesis, the actual class enrolled in by the students was compared to the class that had been recommended by the counselors at time of admission. Counselors can recommend one of four mathematics classes based on the outcomes of the placement test: If a student received a score between 1 and 5 on the placement test they are recommended to take mathematics 021 (Basic Mathematics). If a student received between 6 and 11 they were recommended to take mathematics 101 (Beginning Algebra). If a students score was between 12 and 16 they were recommended to take mathematics 160 (Intermediate Algebra). Only when a student received between 17 and 21 were they recommended to take their first college level mathematics class, mathematics 161 (College Algebra). At this time the student were given a choice to either take mathematics 161 or mathematics 163 (Plane Trigonometry) it was totally the students decision. The student's recommended mathematics class was crosstabulated with the actual mathematics class taken. A list of all mathematics classes offered at MCC are
found in Appendix E. The results of this analysis are shown in Table 5.

Table 5
Courses Taken by Courses Recommended

<table>
<thead>
<tr>
<th>Actual Course Taken</th>
<th>021</th>
<th>101</th>
<th>160</th>
<th>161</th>
<th>163</th>
<th>167</th>
<th>261</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rec. 021</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>021</td>
<td>21</td>
<td>12</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>101</td>
<td>2</td>
<td>32</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>160</td>
<td></td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>161</td>
<td></td>
<td>7</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>45</td>
<td>20</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>106</td>
</tr>
</tbody>
</table>

Of the 106 students who took mathematics placement tests, 36 students were advised to take Mathematics 021. Of these 36 students, 21 took the recommended class while 15 took courses at a higher level. Fifty students were advised to take Mathematics 101, with 32 following the recommendation, and 16 taking courses at a higher level, contrary to counselors' recommendations. Two students chose to take a lower level mathematics class. Mathematics 160 placement was recommended to eight students, with four following the recommendations and four taking Mathematics 161, which is the first college level algebra class. Ten students were advised to take Mathematics 161. Seven students followed this recommendation, while three took higher level classes. Five students took classes beyond entry level recommendations and two students who took mathematics placement tests did not receive a recommended course.
and took either Mathematics 101 or Mathematics 160. The counseling department at MCC stated that there are three possible reasons a student who has taken the mathematics placement test does not have a recommended class. One, either the student was a guest student or a high school student. Two, the student never returned to counseling after taking the placement tests for advisement. Three, the recommended mathematics class never got posted to the student's file.

A Sign test was performed to determine if the classes taken were significantly different from the recommended classes. The results of this analysis are presented in Table 6.

Table 6
Sign Test

<table>
<thead>
<tr>
<th>Recommended Courses by Actual Course Selection</th>
<th>Cases</th>
<th>Difference</th>
<th>z Value</th>
<th>Prob of z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Selection 2</td>
<td>2</td>
<td>5.71</td>
<td>≤ 0.5</td>
<td></td>
</tr>
<tr>
<td>Higher Selection 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Followed 64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommend Total 106</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to the Sign test performed on the data, the differences between the actual course selected and the recommended course was statistically significant at an alpha level of .05. Sixty-four students followed recommendations for mathematics courses, 40 students took classes that were at a higher level than those recommended, and two students took courses that were at a
lower level than those recommended. As a result of this analysis, the null hypothesis that students taking the mathematics placement test followed advised mathematics class suggestions was rejected.

Research question 2, "Does the mathematics placement test taken before entrance to MCC accurately place students in mathematics classes?" was answered by testing Research Hypothesis 2, "Mathematics placement tests currently place students in appropriate mathematics classes according to ability." In order to test the hypothesis, the students who took placement tests were separated into two groups, one group which took the recommended class and a second group which did not take the recommended class. The grades for each of the students in their first mathematics class were then divided into "pass", "fail" or "incomplete/withdrawal". The results of this analysis can be found on Table 7.

Table 7

<table>
<thead>
<tr>
<th>Grade in Class Taken</th>
<th>Followed Recommended Class</th>
<th>Did Not Follow Class</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing</td>
<td>35</td>
<td>20</td>
<td>55</td>
</tr>
<tr>
<td>Did not pass</td>
<td>18</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Incomplete/Withdrawal</td>
<td>11</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>42</td>
<td>106</td>
</tr>
</tbody>
</table>

Chi Square=1.94  df = 2

Of the 106 students who took placement tests, 64 followed the counselor's recommendation on the mathematics class they should enroll in, while 42 did not. Thirty-five of the students who followed
recommended coursework passed, compared to 20 of the students who did not follow the recommended coursework, but passed. Ten of the students who did follow the recommendations of the counselor did not pass, and another 12 did not get either a passing or failing grade, but instead had either an incomplete or withdrew from the class. The students who did not take the counselor's recommendations showed failures in 18 cases, and 11 of the students either obtained an incomplete or withdrew from the class. A chi square analysis was performed on these data to determine if successful completion of the course was dependent on following the counselor's recommendations. The chi square value of 1.94 was not statistically significant at an alpha level of .05 with 2 degrees of freedom. This result indicates that the two variables are not related and success in the mathematics class is not dependent on following the recommendations of the counselors based on the outcomes of placement tests.

Research question 3, 'Is there a difference in the final grades among students who the took mathematics placement test and took the recommended courses, who took the mathematics placement tests and did not take the recommended courses, and who did not take the mathematics placement test?' was addressed by testing Research Hypothesis 3, "There will be no difference in the final grades among students who took mathematics placement tests and took the recommended courses, students who took mathematics placement tests and did not take recommended courses; and students who did not take mathematics placement tests." In order to test this hypothesis, the students were divided into three groups, those who
took mathematics placement tests and followed recommendations, those who took mathematics placement tests and did not follow recommendations and those who did not take mathematics placement tests. The three groups were crosstabulated with class outcomes of pass, fail and did not complete. A Kruskal-Wallis Oneway Analysis of Variance was used to test the significance of the final outcomes. Table 8 reports the results of the analysis.

<table>
<thead>
<tr>
<th>Group Membership</th>
<th>Did not pass Class</th>
<th>Did not Complete</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Took Rec. Class</td>
<td>35</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>Did not take Rec. Class</td>
<td>20</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Did not take Placement Test</td>
<td>36</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>38</td>
<td>30</td>
</tr>
</tbody>
</table>

As shown by the table, 91 students in the study passed their first mathematics class and 38 failed. Thirty students failed to complete the first mathematics class they enrolled in. Of those that passed, 35 (54.7%) had taken the recommended coursework compared to 20 (46.6%) of those who did not take the recommended coursework, and 36 (67.9%) of those who had not taken the mathematics placement test. Failures of those who followed recommendations occurred in 18 (28.1%) of the cases, while withdrawals or incompletes were received by 11 (17.2%) of these
students. Ten (23.8%) of the students who had not enrolled in recommended courses failed, while 12 (28.6%) either withdrew or received incompletes in these classes. Of the 53 students who had not taken mathematics placement tests, 10 (18.9%) had failed and seven (13.2%) had not completed the course to receive a final grade.

In order to test the significance of these findings, a Kruskal-Wallis Oneway Analysis of Variance was performed on the data. The results of this analysis are shown in table 9.

Table 9
Kruskal-Wallis Oneway Analysis of Variance

<table>
<thead>
<tr>
<th>Final Grade Outcome by Group Membership</th>
<th>Mean Rank</th>
<th>Chi Square</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Took Recommended Course</td>
<td>64</td>
<td>80.26</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Did Not Take Recommended Course</td>
<td>40</td>
<td>88.31</td>
<td></td>
</tr>
<tr>
<td>Did Not Take Mathematics Placement Test</td>
<td>53</td>
<td>70.45</td>
<td></td>
</tr>
</tbody>
</table>

The results of the Kruskal-Wallis Oneway Analysis of Variance yielded a chi square value of 3.60, which was not statistically significant at an alpha level of .05. This finding indicates the three groups were not significantly different in final grade outcomes. As a result, the null hypothesis stating that there will be no difference in the final grades among students who took mathematics placement tests and took the recommended course, students who took mathematics placement tests and did not take the recommended
course and students who did not take the mathematics placement test is retained.

Research question 4 "Does the mathematics placement test predict the students' overall academic achievement in mathematics?" was answered by testing Research Hypothesis 4, "There will be no difference in mathematics grade point average of students completing mathematics placement tests and those who do not complete the tests." A t-test for two independent samples was used to test this hypothesis. The dependent variable for this analysis was the overall grade point averages for all mathematics classes taken while the students attended MCC. The independent samples were students who had taken mathematics placement tests prior to enrolling in classes for the first time and students who had enrolled and started classes before taking the placement tests. The results of the students' grades by group membership are provided by Table 10.

Table 10

<table>
<thead>
<tr>
<th></th>
<th>Took Placement Test</th>
<th>No Placement Test</th>
<th>t value</th>
<th>prob of t</th>
</tr>
</thead>
<tbody>
<tr>
<td>N X S</td>
<td>144 2.01 1.37</td>
<td>80 2.59 1.26</td>
<td>3.80</td>
<td>*</td>
</tr>
</tbody>
</table>

*p ≤.05
The t-value of 3.08 achieved by testing the difference between the mean grade point averages in mathematics classes of students who had taken mathematics placement tests and those who had not completed mathematics placement tests was statistically significant at an alpha level of .05 with 222 degrees of freedom. Those students who had taken mathematics placement tests had an overall mean grade point average of 2.01 with a standard deviation of 1.37 which compared to a mean grade point average for all mathematics classes taken of 2.59, with a standards deviation of 1.26. Although the students who did not take mathematics placement tests had higher grade point averages for all classes taken in mathematics, this difference was statistically significant, which leads to rejection of the null hypothesis. There was a difference in the mathematics grade point average of students completing mathematics placement tests and those who did not complete the test.

Research question 5, "Does successful placement of students in mathematics classes make a difference in the retention rate of students in mathematics classes?" was answered by testing Research Hypothesis 5, "There will be no difference in the retention of those students who took the mathematics placement test and those students who did not". In order to test this hypothesis, a chi square was used to determine the difference between the students who took mathematics placement tests and the students who did not take mathematics placement tests. The results of the semesters enrolled by group membership are provided in Table 11.
Table 11

<table>
<thead>
<tr>
<th>Number of Semesters</th>
<th>Not Tested</th>
<th>Tested</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53</td>
<td>106</td>
<td>159</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
<td>53</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>31</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>5 or more</td>
<td>3</td>
<td>17</td>
<td>20</td>
</tr>
</tbody>
</table>

For the purpose of this study the semesters students were enrolled in a mathematics class ranged from one to five or more. Of the 105 classes taken by students who did not take mathematics placement tests, there were 53 classes taken the first semester they were enrolled. There were 27 classes taken the second semester and 3 classes taken between the fifth and ninth semester. From the 222 classes taken by the students who took mathematics placement tests, there were 106 classes taken the first semester. The second semester, 53 classes were taken, and 17 classes were taken the fifth to the ninth semester. The presentation of the retention of students at MCC is for mathematics classes only. The data does not provide needed information regarding retention beyond knowing which semesters the students enrolled in mathematics classes. All students (53 who had not taken mathematics placement tests and 106 who had completed those tests) in the study took a mathematics class in the first semester. The subsequent semester shows that 27 students who had not taken mathematics placement tests had enrolled in a second mathematics class or perhaps had repeated their first mathematics class, while 53 of the students who had taken the
mathematics placement test had enrolled in another mathematics class. What the data does not provide is whether the students who are not represented in the second semester remained at MCC and were in other classes or whether they had dropped after the first semester. The same logic applies to the third and following semesters. Information is not readily available on whether or not the students who had enrolled in classes in the 4 or 5 semesters following their first semester are taking their fourth mathematics class or are taking a second mathematics class. The null hypothesis that there will be no difference in the retention of those students who took the mathematics placement test and those students who did not is rejected.

Other Findings

In looking at the community colleges, it is apparent that for millions of students, two-year college education represents the last real opportunity to develop an interest in science, mathematics or engineering and to develop the prerequisite skills for careers of the 90's (Parilla,1989). The major codes (see Appendix E) for the students who took a mathematics placement test and the students who did not take a mathematics placement test was recorded on their records. The results of this summarization of data are shown in Table 12.
Table 12

Majors by group membership

<table>
<thead>
<tr>
<th>Program</th>
<th>Tested</th>
<th>Tested</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentice</td>
<td>6</td>
<td>343</td>
<td>39</td>
</tr>
<tr>
<td>Business</td>
<td>27</td>
<td>59</td>
<td>86</td>
</tr>
<tr>
<td>Fine Arts</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Counseling/Guidance</td>
<td>9</td>
<td>22</td>
<td>31</td>
</tr>
<tr>
<td>Language</td>
<td>6</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Nursing</td>
<td>2</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Science/Mathematics</td>
<td>42</td>
<td>49</td>
<td>91</td>
</tr>
<tr>
<td>Social Science</td>
<td>9</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>Undecided</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>222</td>
<td>327</td>
</tr>
</tbody>
</table>

The results indicate that of the students who took the mathematics placement test the highest number, 59 students, chose business as their major. The next highest, 49 students, chose science and mathematics as their major. This was the reverse for the students who did not take the mathematics placement test. The highest number of students, 42, chose science and mathematics for their major. The next highest number, 27 students, chose business as their major. There were major differences in the students who took placement tests and those who did not take placement tests.
CHAPTER 5
Summary, Conclusions, and Recommendations

Mott Community College (MCC) is located in Flint Michigan, approximately 75 miles north of Detroit. The college has been in existence since 1923 and is considered one of the leading community colleges in Michigan. In Fall, 1991, there were approximately 11,500 student enrolled in one of 55 different programs from which they can either receive a degree or a certificate. MCC has an open door policy that permits any student graduating from high school, or 19 years old or older, to be admitted. Once admitted, students must take a mathematics placement test before enrolling in classes. A review of the literature concludes that while no community college requires an examination prior to admission, 52% require an examination prior to registration (Rivera, 1981). Cox (1985) further states that it is society's responsibility to provide open access to opportunities provided only through postsecondary education. The monitoring of student success is a way of being responsible for student success. Through open access and student success, this can be done in all community colleges. MCC is one of 29 colleges in Michigan; of these colleges, 72% indicated that they required testing of all newly admitted students, though 86% said that testing could be waived; and nearly 45% of the colleges had mandatory placement in mathematics.

In the Fall Semester, 1985, the testing cut-off date at MCC did not allow enough time for all students applying for admission to be tested. Therefore, in order to accommodate the students, the college
allowed 239 students to take classes without taking the mathematics placement test. Subjects for this study consisted of 239 First Time In Any College (FTIAC) students at MCC who took the mathematics placement test and 239 FTIAC students who did not take the mathematics placement test. The purpose of this study was to determine if the mathematics placement test at MCC was a predictor of students' success in their mathematics classes. From the population of students who did and did not take mathematics placement tests, students were selected on the basis of whether or not they took mathematics the first semester they enrolled. The sample for this study consisted of 106 students who took the mathematics placement test and took a mathematics course the first semester they enrolled. The second group in the sample included 53 students who did not take mathematics placement test and took a mathematics course the first semester they enrolled. This study determined the following: 1) Did the students who took the mathematics placement test take the advised mathematics class? 2) Does mathematics placement test taken before entrance to MCC accurately place students in mathematics classes? 3) Is there a difference in final grades among students who took the mathematics placement test and took the recommended courses, who took the mathematics placement test and did not take recommended courses, and who did not take the mathematics placement test? 4) Does the mathematics placement test predict the students' overall academic achievement in mathematics? 5) Does successful placement of students in mathematics classes make a difference in the retention rate of students in mathematics classes?
The material used for this study was the mathematics placement test, recommended class, mathematics class/es taken by both groups, grade point averages from mathematics classes taken for both groups, retention rates for both groups, and the sequence in which students took their classes.

The students who were selected for this study spanned the age range from 17 to 46 years of age, with the majority under 26. There were 73 females and 86 males among the sample, 124 Caucasians and 23 African-Americans. Other ethnic groups represented included American Indians, American Asians and Hispanics.

Research question 1, "Did the students who took mathematics placement tests take the mathematics class they were advised to take?" was answered by crosstabulating the actual mathematics course taken with the recommended mathematics course. Of the 106 students in the study who took the mathematic placement tests prior to enrolling in any class, 64 took the recommended, mathematics courses, two took courses at a level lower than recommended and 40 enrolled in mathematics courses at a higher level than were recommended by the counselors. A nonparametric statistical analysis using a Sign test was performed to see if the enrollment pattern was significantly different from the counselor's recommendations. The results of this statistical analysis indicated a statistically significant result, which led to the rejection of the null hypothesis. The students did not take the recommended mathematics class suggestions.

Research question 2, "Does the mathematics placement test before entrance to MCC accurately place students in mathematics?"
was answered by crosstabulating the success or failure of the student by following or not following recommended mathematics course suggestions. A chi square analysis was completed on this data to determine the statistical significance of the findings. The crosstabulations showing "pass", "fail" or "incomplete/withdrawal" status showed that 35 of the students who took the recommended courses passed compared to 20 who did not follow the recommended mathematic courses. Failures were found for 18 students who followed the recommended coursework and 10 students who did not follow the recommended mathematics courses. Withdrawals and incompletes were given to 11 students who took the recommended coursework and 12 students who did not follow the counselor's suggestions. The chi square analysis failed to yield a statistically significant difference in final outcomes based on grades and if the students followed or failed to follow recommended mathematic course suggestions based on the results of the mathematics placement test. The null hypothesis was retained as a result of this analysis. The mathematics placement test does not appear to correctly place students in the proper entry level mathematics course.

Research Question 3, "Is there a difference in the final grades among students who took mathematic placement test and took the recommended course, who took mathematics placement test and did not take the recommended course, and who did not take the mathematics placement test?" was addressed by crosstabulating the three groups with their final mathematics outcomes on their first mathematics course. The crosstabulation shows that students who
did not take the mathematics placement test had higher passing rates (67.9%) compared to those who took the mathematics placement test and followed recommended coursework (54.7%) and to those who took the mathematics placement test and did not follow recommended coursework (47.6%). In order to test the significance of this analysis, a Kruskal-Wallis One-way Analysis of Variance was performed to determine if there was a difference in grades based on whether they had taken the mathematics placement test and followed recommended coursework or had not taken the mathematics placement test. The result of the statistical analysis was not significant which led to the retention of the null hypothesis that there was no difference in final grade on the first mathematics class enrolled, based on the method used to select the course.

Research question 4, "Does the mathematics placement test predict the student's overall academic achievement in mathematics?" was answered by testing the overall grade point averages of the students who took mathematics placement test and those who did not take the tests using a t-test for two independent samples. The result of this test was statistically significant with the students who had not taken the mathematics placement test having a mean grade point average of 2.59 compared to those who had taken the mathematics placement test and achieving a mean grade point average of 2.01. This finding led to the rejection of the null hypothesis. There is a statistically significant difference in the overall grade point averages of the students who did and did not take mathematics placement tests.
Research question 5, "Does successful placement of students in mathematics classes make a difference in the retention rate of students entering MCC?" was addressed by crosstabulating the students by mathematics classes taken in each semester from the semester of first enrollment to the most current semester for which records were available. There is a steady decline in the number of students enrolling in mathematic classes from the first semester to the most current semester, but that is to be expected as the number of students who continue in a mathematics oriented curriculum is fewer than those in the other major areas of study. This study examined only mathematics classes which may not have been taken every semester, while the students remained at the college actively enrolled in other classes, such as liberal arts, vocational/technology, science, etc. The null hypothesis that there will be no difference in the retention of those students who took the mathematics placement test and those students who did not is rejected.

Discussion

Placement tests for students have become an accepted part of the admissions criteria at the community college, especially for those with open door policies. Often these students enter college with less than college level aptitudes in English and mathematics and need remedial work prior to starting "college-level" coursework. These students are tested and counseled as to the proper course selection they should make. In order for these tests to accurately place the students at the proper level for their ability, the test must reflect the
skills the student needs to know in order to begin each level of the class. Mathematics, especially, is a building block type of program with each subsequent level of coursework depending upon mastery of the lower levels in order for the student to successfully complete the sequence. The mathematics placement test at Mott Community College was developed in-house by faculty members. It is not known if the test was subjected to rigorous testing for validity and reliability.

According to the results of this study, students who take the mathematics placement test are ignoring suggestions of the counselors in sufficient numbers. The mathematics faculty should look at the test to determine if the scoring of the test should be reevaluated so that test results will more accurately reflect the abilities of the students. The students who did not follow the recommended coursework took classes that were at a higher level than those recommended by the counselors. Those students who entered and did not take the mathematics placement test and those who did not follow suggestions of the counselors did better than those who took the recommended mathematics coursework. This finding supports the conclusion that the placement test needs reevaluation.

This reevaluation could be accomplished through a standardization process with students who have completed each level of the courses retaking the mathematics placement test. These scores could form the basis of a data base that would provide evidence of the average scores needed on any particular section to show mastery of that section. Until a set of standard scores is
established, the test should be used in an advisory capacity; previous history of mathematics classes, along with other pertinent factors, should also be used by the counselors prior to recommending a particular mathematics class.

Recommendations for Further Research

The results of this study have created more questions than the research answered. As a result, the following recommendations for further research in this area are suggested.

1. Replicate the study, but extend it to include reading and English classes to determine if placement tests are accurate in properly placing students in these areas.

2. Have students complete the mathematics placement test at the end of each mathematics course to provide a data base of end scores to establish standardized norms that counselors could use in their student advising.

3. Compare results of the placement test on retention to determine if students who complete recommended coursework are successful and, as a result, are retained by the college.

4. Compare results of MCC students who have taken placement tests with students at other community colleges to determine if
placement tests, in general, are serving the purpose for which they were originally intended.

5. Have the mathematics/science department at MCC review the Title III project from Kirkwood Community College (see Appendix G) to develop/select a mathematics placement test that can determine the best criteria to assist students in selecting the correct level of mathematics at which to begin their study.

Chapter Five has presented the summary and conclusions of the study on the validity of the mathematics placement test. Students who did not take the mathematics placement test, which was a one-time only occurrence in fall semester, 1985, and students who did not follow recommended coursework, did as well or, in some cases, better than students who took the mathematics placement test and followed the recommended coursework. These results indicate that the mathematics faculty of the college needs to re-examine the validity and reliability of the mathematics placement test, as well as its scoring.
HISTORY

A CAI system was installed on MCC campus during and for Winter Semester 1989. Following a rigorous examination and statistical investigation, it was determined that the system did not meet the needs of the Mott Community College population; students and faculty. The system was removed during the Spring session, 1989.

Summer and Fall found project researchers Fran Smith and Joyce Toet crossing the country examining CAI systems for possible use at MCC. Systems in Chicago, Detroit, University of Illinois and Orem, Utah were studied and compared.

The October, 1989 visit to Utah convinced the team that the WICAT system most closely met the needs of MCC students and faculty. These needs had been determined by the prior study. Project details were worked out and WICAT was placed on campus for a 120 day trial beginning February 1, 1990.

Training was accomplished for faculty and staff during the period of January 16, 1990 (system arrival on campus) and January 31, 1990. Mr. Chris Cook from WICAT Educational Services and his associate Denise Elliot did the training for Kelly West, Lab Technician, Fran Smith and Joyce Toet as system troubleshooters and liaison personnel. Students formally began using the lab on February 1, 1990.

Several teachers are using the lab, or assigning lab work as part of their class assignments. Students were pre tested and post tested to determine academic progress and surveyed for attitude changes, (positive or negative) toward computer usage in academic areas. The specific teachers and areas of academic coursework are:

Mr. Stan Gooch, Basic Math
Beginning Algebra

Mr. Richard Hoffman, Basic Sentence Skills

Mrs. Freida Smith, Reading (1 section)

Mrs. Carolyn Post, Reading (1 section)

Two sections of Reading were designated as experimental because enrollment was so small in each section. The two sections equalled one regular class size.
Control classes were identified and tested to use as a comparison to those classes/students using the WICAT CAI system. Control classes were:
Math 021, Dan Selke
Math 101, Ms. Flynn
English 098, Joe Bommarito
Reading 020, Freida Smith

DEFINITION OF THE PROBLEM:

Need for an instructional enhancement instrument, such as computer aided instruction, becomes relatively obvious when one realizes that approximately one third of students enrolled at Mott currently read at or below ninth grade level, and fully 66% of Mott entering students read below college level. Other students lack requisite skills - basic skills - in English, math and algebra. These students encounter academic difficulties due to a discrepancy between their skills and the skills required to be successful in college level classes.

The major focus of the CAI project was to determine, over a semester period, effectiveness of WICAT computer aided instruction in satisfying the academic needs of this population of students. A prior study had been conducted to determine the relative effectiveness of CAI with this population. The concept of CAI was determined to be of value, although the prior system was not optimal.

A semester long trial period was determined via an agreement with the Computer company and Mott Community College. After the trial period, evaluation was conducted by a team of Mott researchers. A determination regarding continued usage of WICAT system based on statistical analysis of recorded data was made. Also considered were written exit surveys by students, staff and faculty regarding their experiences with the WICAT delivery system of CAI.

COMPUTER SYSTEM CONFIGURATION

The WICAT educational system at Mott was designed as a stand alone system with a hot line arrangement with WICAT system operators. The former Social Science reading room was converted during Fall semester,
1988, to accommodate a computer lab (Curtice-Mott 1111). Configuration for the Mott installation consisted of 30 individual student workstations with a small central processing unit (CPU) and management terminal. The management terminal served as a system manager by providing software lesson modules to individual student workstations.

WICAT is controlled by a 702 megabytes (MB) hard disk drive microprocessor. This CPU has formatted hard disks that store the WICAT courseware. The CPU uses a 60 MB cassette tape for back-up file copies and for loading new software. A cassette stores a once a month complete back up file, another is used to store daily and weekly student activity records as back up in case of system failure. It also includes 6 MB of random access memory (RAM) to store student activity records.

Student workstations are comprised of 30 WICAT dumb terminals with monochrome display and an audio system that can be used with headphones. All workstations are connected to the CPU by coaxial cables.

A dot matrix printer is connected to the CPU through the management terminal to generate hardcopy student status reports and such whole class overview reports as needed.

The courseware available on the system is comprised of nine different products. These nine products cover remediation lessons from beginning reading and math through high school level social science, math and science courses.

The initial WICAT package includes all hardware, software licenses, on site training and the first year maintenance contract; everything needed to set up the computer aided instruction lab for use by students and instructors.

There is an additional on going yearly charge for annual software licenses that guaranteed updates of courseware, an 800 hotline, additional inservice training on an as needed basis and an annual selection of new products. An annual maintenance contract on equipment is also required. This covers time, travel and materials necessary to keep the lab functional at all times.
POPULATION

Those students who registered for basic math at 8:00 a.m., algebra classes at 10:00 a.m., English 098 classes at 9:00 a.m. or reading classes at 11:00 a.m. became the population for this study.

An important aspect of any true experimental study is the random placement of students into the experimental and control groups. Complete randomization of subjects was ensured by running shadow sections. To do this, no instructor was listed for the course in any advertised materials nor on the computer terminal used by School advisors, and double the enrollment was allowed. At the first class meeting, students were placed in either experimental or control classes alternately according to the mass enrollment sheet. Those enrolling late were placed in classes on an alternating basis, one into experimental and one into control classes. An option was given to students that if they had serious concerns related to the course in which they were placed, they could change sections. This option was not exercised by any student, in any section.

As students began each class, they were asked to complete a demographic questionnaire and through the persistence of the researcher, a 100% return rate was achieved. Using results of this demographic survey, it is possible to compare students in the study to Mott students at large.

One caveat must be mentioned at this point. All students in the study had been identified as needing some remediation or developmental help, either by placement test scores or self determination. All classes in the study were "0" level courses except Math 101 which is a non-transferable beginning algebra course. None of these courses are college level studies. Not all Mott students need remedial help. Other than this area, project students were quite representative of Mott students.

<table>
<thead>
<tr>
<th>Age of students</th>
<th>Project</th>
<th>All College</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 19</td>
<td>23.0%</td>
<td>10.3%</td>
<td></td>
</tr>
<tr>
<td>20 - 29</td>
<td>44.8%</td>
<td>49.0%</td>
<td></td>
</tr>
<tr>
<td>30 - 39</td>
<td>23.6%</td>
<td>28.0%</td>
<td></td>
</tr>
<tr>
<td>40 - 49</td>
<td>8.0%</td>
<td>10.2%</td>
<td></td>
</tr>
<tr>
<td>50+</td>
<td>0.6%</td>
<td>2.5%</td>
<td></td>
</tr>
</tbody>
</table>

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The decade of 20 - 29 was the most heavily represented both in the project and college wide. A breakdown of mean age in each class is as follows:

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Algebra mean age</td>
</tr>
<tr>
<td>Basic Math mean age</td>
</tr>
<tr>
<td>English mean age</td>
</tr>
<tr>
<td>Reading mean age</td>
</tr>
</tbody>
</table>

Again, the mean of all classes falls into the 20 - 29 decade, albeit towards the mid to upper ranges.

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Sex of student</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
</tbody>
</table>

The ratio of men to women remains rather constant from project to college wide figures.

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Ethnicity of students</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Black</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>Native American</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

These were the only comparisons possible, as other demographic data are not available on the registrar's computer. However, more information of the type of people participating in the CAI project is available from the demographic survey conducted for this study.

The marital status of the population was widely varied as may be the case college wide.
TABLE 5

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single - never married</td>
<td>58.0%</td>
</tr>
<tr>
<td>Married</td>
<td>17.8%</td>
</tr>
<tr>
<td>Divorced</td>
<td>14.4%</td>
</tr>
<tr>
<td>Widowed</td>
<td>1.7%</td>
</tr>
<tr>
<td>Separated</td>
<td>8.0%</td>
</tr>
</tbody>
</table>

The participants in the CAI project (control and experimental) were surveyed to find out their birth order in relation to siblings.

TABLE 6

<table>
<thead>
<tr>
<th>Birth Order</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youngest child</td>
<td>29.3%</td>
</tr>
<tr>
<td>Oldest child</td>
<td>23.6%</td>
</tr>
<tr>
<td>Middle child</td>
<td>43.1%</td>
</tr>
<tr>
<td>Only child</td>
<td>2.9%</td>
</tr>
<tr>
<td>No response to question</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

The percentages seem to indicate that middle children participated in our study more than did older or younger siblings. Only children are infrequently represented in our population. We have no easy way to determine if this is representative of the college population in general, or is particular only to the study population.

The respondents were asked for geographic area of residence. Results were:

TABLE 7

<table>
<thead>
<tr>
<th>Location</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genessee County</td>
<td>36.2%</td>
</tr>
<tr>
<td>City of Flint</td>
<td>53.4%</td>
</tr>
<tr>
<td>Outside Genessee County</td>
<td>10.3%</td>
</tr>
</tbody>
</table>

The results indicate that students are representatives of the target market of Mott's mission statement to serve the residents of Genesee County.

Participants were surveyed as to the amount of family yearly income. Results were:

TABLE 8
Less than $4,999 26.4%
$5,000 to $14,999 27.0%
$15,000 to $24,999 9.2%
$25,000 to $39,999 12.6%
$40,000 to $54,999 12.1%
Over $55,000 6.3%
No response to question 6.3%

Students were asked if they receive financial aid to attend Mott College. Results showed:

**TABLE 9**

<table>
<thead>
<tr>
<th>Receive financial aid</th>
<th>62.1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not receive financial aid</td>
<td>37.9%</td>
</tr>
<tr>
<td>(includes students whose parents are paying for college)</td>
<td></td>
</tr>
</tbody>
</table>

The number and type of grants was also surveyed and the results were:

**TABLE 10**

<table>
<thead>
<tr>
<th>No financial aid</th>
<th>36.2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pell</td>
<td>52.9%</td>
</tr>
<tr>
<td>TRA</td>
<td>6.3%</td>
</tr>
<tr>
<td>Various Scholarships</td>
<td>1.1%</td>
</tr>
<tr>
<td>Other</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

Students were surveyed for prior use of computer keyboards in an academic situation. Results showed a nearly equal distribution.

**TABLE 11**

<table>
<thead>
<tr>
<th>Prior computer keyboard experience</th>
<th>50.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No prior computer keyboard experience</td>
<td>49.4%</td>
</tr>
</tbody>
</table>

Students were asked to report their declared majors. The results showed:
TABLE 12

<table>
<thead>
<tr>
<th>No major identified yet</th>
<th>31.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health occupations</td>
<td>33.3%</td>
</tr>
<tr>
<td>Business</td>
<td>20.7%</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>6.9%</td>
</tr>
<tr>
<td>Vocational</td>
<td>5.7%</td>
</tr>
<tr>
<td>No response to question</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

Students were surveyed to determine level of previous education (prior to entry into this class).

TABLE 13

<table>
<thead>
<tr>
<th>11th grade or less</th>
<th>1.1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>12th grade</td>
<td>59.2%</td>
</tr>
<tr>
<td>G.E.D.</td>
<td>7.5%</td>
</tr>
<tr>
<td>Some college</td>
<td>31.6%</td>
</tr>
<tr>
<td>AA or above</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

Students were asked about any prior experiences in Special Education; such as in elementary or high school classes.

TABLE 14

<table>
<thead>
<tr>
<th>Elementary special education classes</th>
<th>12.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school special education classes</td>
<td>12.1%</td>
</tr>
<tr>
<td>No special education classes</td>
<td>75.3%</td>
</tr>
</tbody>
</table>

If students indicated that they had taken special education classes, they were asked which kind(s) of class(es) they were part of. More than one response choice was allowed.

TABLE 15

<table>
<thead>
<tr>
<th>Special Classes for Learning Disabled</th>
<th>7.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech Therapy</td>
<td>4.6%</td>
</tr>
<tr>
<td>Reading Improvement</td>
<td>19.3%</td>
</tr>
<tr>
<td>Math Improvement</td>
<td>13.2%</td>
</tr>
</tbody>
</table>
The number of years of participation in special education classes was asked of all participants. The responses showed:

**TABLE 16**

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not apply</td>
<td>55.2%</td>
</tr>
<tr>
<td>1 - 2 years</td>
<td>19.0%</td>
</tr>
<tr>
<td>3 - 4 years</td>
<td>5.7%</td>
</tr>
<tr>
<td>5 or more years</td>
<td>2.8%</td>
</tr>
<tr>
<td>No response to question</td>
<td>17.2%</td>
</tr>
</tbody>
</table>

Students were asked if they had ever been diagnosed as having a learning disability. The responses showed:

**TABLE 17**

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formally diagnosed as Learning Disabled</td>
<td>9.2%</td>
</tr>
<tr>
<td>Never diagnosed as Learning Disabled</td>
<td>87.4%</td>
</tr>
<tr>
<td>No response to question</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

**EXPERIMENTAL DESIGN**

Nine classes were involved in the study. All are developmental in content. Two classes of Math 101, two classes of Basic Math 021, two classes of Basic Sentence Skills - English 098, three classes of Reading Improvement - English 020 comprised the nine classes which constitute the population for this study. Reading used three classes, due to small class size after final registration period.

One section of each academic area was designated control. One was designated experimental and received the “treatment variable” by being assigned lab time as homework, which were required assignments. (Two reading classes were combined to form one experimental group due to the small size of the classes.)

Each of the classes met as usual during the Winter semester of 1990. Home work assignments were given in all sections. Experimental groups
had CAI homework time and control classes had the usual text based drill and practice exercises.

At the beginning of the semester, each member of six identified classes (reading was excluded) was given the T.A.B.E. (Test of Adult Basic Education) exam. This was to determine the functioning level of the individual student and to be used as a baseline to determine progress at the end of the semester. The Reading classes use the Nelson Denny as a regular part of their class and it has been determined to be an excellent test (reliable and valid). Nelson Denny became the pre and post test for the reading course.

The ratio of drill and practice to lecture was held as nearly equal as practicable in a classroom setting. This was done to make the CAI experience as equitable to paper and pencil drill as possible. The hours of homework were also regulated to make the homework sections of the courses as equitable as possible.

The students proceeded through the semester's work.

After completion of the semester's work, all members of the six classes were retested with the T.A.B.E., and the Reading classes were post tested with the Nelson Denny. For those remaining in class, the post test result was compared to the pre test result to determine cognitive gain in the skill (math, English or reading) for each student. Furthermore, the class participants were post tested with the attitude survey to determine if there were any changes in attitude toward computer aided instruction after having experienced the CAI system for a full semester.

Students were also surveyed to see if they enjoyed this class, was it profitable, did they learn the material and did they recommend this class format to other students. They were also asked if they tended to interact with their fellow students outside of class time.

Data gathered was used to answer six important questions regarding CAI - WICAT.

1. Is WICAT CAI effective for remedial/developmental students at Mott?

2. What is the average progress made?
3. Do students show more progress using WICAT than with the PLATO system?

4. Do students like WICAT CAI?

5. Which students made greater cognitive gains with WICAT CAI?

6. Should CAI as presented by WICAT be offered at Mott?

To capsulize this design, it is a double experimental design. The design uses both a pre and post methodology and a dual group design (experiment group versus control). This duality of design was required to allow comparisons within each group as well as between groups.

**CURRICULAR SYSTEM ANALYSIS**

The first and foremost question for analysis asks “Is WICAT delivery of CAI effective for remedial/developmental students?” The answer must be an unqualified, YES.

The mean cognitive gain for all experimental classes is 4.16 grade levels compared to 2.53 grade levels for the control groups.

When the data is listed as separate classes, the outcome is as follows:

<table>
<thead>
<tr>
<th>Mean Improvement</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 021</td>
<td>5.27</td>
<td>4.98</td>
</tr>
<tr>
<td>Math 101</td>
<td>5.26</td>
<td>0.96</td>
</tr>
<tr>
<td>English 098</td>
<td>4.11</td>
<td>3.19</td>
</tr>
<tr>
<td>English 020</td>
<td>1.94</td>
<td>0.99</td>
</tr>
</tbody>
</table>

In all classes, the mean is higher for the classes using the WICAT CAI system.

Completion rates need to be considered to determine the success rate of WICAT CAI system.
### Table 19

<table>
<thead>
<tr>
<th>Completion rate</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 021</td>
<td>55.6%</td>
<td>36.8%</td>
</tr>
<tr>
<td>Math 101</td>
<td>50.0%</td>
<td>47.6%</td>
</tr>
<tr>
<td>English 098</td>
<td>87.0%</td>
<td>67.0%</td>
</tr>
<tr>
<td>Reading 020</td>
<td>69.0%</td>
<td>70.0%</td>
</tr>
</tbody>
</table>

With the exception of the reading class which showed nearly equal attrition rates, the experimental classes held significantly more students to completion than did the control classes.

Comparison of WICAT CAI system to the former CAI system piloted shows some interesting results.

### Table 20

<table>
<thead>
<tr>
<th>Mean Improvement</th>
<th>Exp.P</th>
<th>Exp.W</th>
<th>Con.P</th>
<th>Con.W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 021</td>
<td>1.90</td>
<td>5.27</td>
<td>1.20</td>
<td>4.98</td>
</tr>
<tr>
<td>Math 101</td>
<td>.70</td>
<td>5.26</td>
<td>.80</td>
<td>.96</td>
</tr>
<tr>
<td>English 024/098</td>
<td>3.30</td>
<td>4.11</td>
<td>3.10</td>
<td>3.12</td>
</tr>
<tr>
<td>Reading 020</td>
<td>1.90</td>
<td>1.94</td>
<td>1.00</td>
<td>.99</td>
</tr>
</tbody>
</table>

With the exception of the Control group of Math 021 in the WICAT study, the Control levels remained relatively constant. However, all but Reading showed dramatic jumps in cognitive gain for WICAT when compared to the PLATO study.

Student/faculty/staff responses via questionnaire at the end of Winter semester showed an overwhelming acceptance of the WICAT system. Negative comments were such as, “Needs to be open longer.” The system needs to be better correlated to the text books in use, but this will happen with continued usage and cannot be expected during first semester usage, especially considering the short turn around time between installation and student usage of the system. Specific survey results are as follows.

The students who made the most dramatic progress were those students who began with lower entry levels. Actual Z scores will be available in the follow up report which will be generated following the conclusion of the Spring/Summer sessions, 1990. This material shows similar results to PLATO, the major exception being the dramatic rise in mean cognitive gain a compared to P!'

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APPENDIX C
Survey Results

FACULTY TUTOR SURVEY

Faculty Tutor Survey (Sample = 20). This sample included faculty and professional and peer tutors.

1. Did WICAT cover material you covered in class?
   Yes 6   No 2   To some extent 8   No answer 4

2. Would you recommend WICAT to your students in the future?
   Yes 19   No 0   No answer 1

3. Does the WICAT lab need to be opened more hours?
   Yes 12   No 5   No answer 3

4. Should Mott continue to offer WICAT computer aided instruction?
   Yes 19   No 0   No answer 1

5. Comments:

"Students need the instruction and direction of a teacher when using the computer aided instruction. A few words of explanation, discussion, encouragement, etc. are very beneficial. The program does indeed challenge the thinking skills of the student."

"There are enormous gaps in the WICAT program and some very important units are missing. I found that less than half of my lessons in 098 have corresponding units in WICAT. In spite of these deficiencies, the program has a lot of potential. I think that the instructor has to take an active role in selecting the material to be worked on by the students."

"The program is set for more hours than our classes meet - could be uses as a tutorial aid - it has some good exercises. If used as in-class instruction, we will have to fine tune to fit our outline."

"The program sounds good, but I really have not had the opportunity to use it."

"I thought is was well structured and very helpful even for my own classes (Physics & Biology)."

"This is so new that I didn't get to recommend many students. However, I was very impressed at the orientation and wouldn't hesitate to send students over."

"I did not get to use WICAT extensively, but the portion that I tried seemed to be well organized for instruction."

"Some students like the WICAT program better than ours in the Reading Lab. Some don't. It's nice that the students have choices. Beyond that, there are only 10 computers in each reading lab. That means we have 15 students that cannot use the computers and they feel somewhat deprived. The WICAT Lab offers them a way to use computers. The 'video generation' you know!"
"Some students prefer to work at their own pace in front of a practice media such as the computer. The lab is an excellent supplement to the instruction offered. Practice does make an improvement and the immediate response of the computer nips bad habits in the bud."

"I enjoyed working with this system. I hope we will be able to use this system or a better system in the future."

"I am using WICAT with three students that I am tutoring. This is an excellent service because students are often confused during class, and the amount to be covered is too overwhelming to handle in tutoring sessions. WICAT allows students to work at their own pace. Also, it allows students to improve specific problem areas. Another advantage is that students feel that working in the lab is fun and interesting. I am teaching Eng 099 this summer and would like to use WICAT with my class."

"Beginning math students can be helped (i.e. basic skills) but as abilities rise WICAT becomes less useful."

"Excellent program."

"WICAT's programming should be expanded, especially in the chemistry area. It should include practice in balancing and naming chemical equations, naming and combining ion/chemical formulas, writing formulas for compounds, and writing Lewis dot structures."

### STUDENT SURVEY

Sample = 121

1. How did you become involved in using WICAT computer aided instruction?
   - Class assignment 101
   - Tutoring Center 4
   - STAR program 1
   - Other 5
   
   (Note: some students are involved in more than one program.)

2. Did you benefit from WICAT enough to use it in future semesters?
   - Yes 101
   - No 14
   - No answer 5

3. How many hours per week did you use the WICAT system?
   - 0 - 1 27
   - 1 - 3 80
   - 3 - 5 10
   - 5 - more 3
   - no answer 1
Survey results are appended to this report indicating the results of survey questionnaires filled in by students, faculty and staff who made use of the WICAT system during the Winter semester, 1990. Results of Spring and Summer sessions will follow in the report update.

**RECOMMENDATION**

It is the recommendation of the researchers based on the results of the controlled study, that the WICAT system be purchased for use at Mott Community College.

It is further recommended that
A. The system as in operation be purchased

Or

B. A WICAT color system with IBM PC's be purchased.
It is understood that the IBM component of the system would (most likely) be sent to bid, rather than purchased from the WICAT Corporation.
ABSTRACT

The Computer Aided Instruction project was undertaken to determine the viability of WICAT system, CAI tutorial intervention on the Mott Campus. Students in CAI developmental classes (Reading, English and Math) were studied and compared to performances of students in Traditional Instruction developmental classes.

At the end of the trial period, evaluation was conducted by Mott researchers to determine the success of the project and the system. Pre and post test means were compared. Attitude toward the class was compared as was retention rates for CAI and TI classrooms.

Results showed significant increases for those enrolled in the CAI sections of all classes.
4. Did WICAT assist you in better understanding your classwork?
   Yes 102  No 18  No answer 1

5. Would you recommend that Mott continue to offer a WICAT lab?
   Yes 117  No 4

6. Would you recommend WICAT to your friends or classmates?
   Yes 113  No 7  No answer 1

7. Did WICAT open lab hours meet your needs?
   Yes 109  No 9  No answer 3

8. If answered no to question seven, please tell how the hours could be changed to better meet your needs.
   "Week-day evening hours."
   "We need more morning hours."
   "Move lab to library/better hours - more hours."
   "Opened at 8:00 instead of 9:00 and stay open between 11:00 and 12:30."
   "Evening hours"
   "If it was open until 5 p.m."
   "Hours later in the day would help."
   "To be open later in the day."
   "8 a.m. - 8 p.m."

9. Comments:
   "Many times the computer had only one correct answer in it, so when an alternative correct answer was typed in it was interpreted as incorrect. This proved frustrating and at times confusing. Other than that, it was extremely helpful and a very good way to provide independent practice and learning. I would highly recommend continuing to use the WICAT system for students."

   "I think the WICAT was very helpful in reading and understanding how to use computers. This is the first time I had used a computer."

   "It didn't benefit me because the classes I was using it for were too easy."

   "Need to follow assignments in book better."

   "It would be of greater value to me as a student if the programs were geared to the same materials as the book."

   "My personal opinion is that it is a fun and easy way to learn reading skills."

   "I think there should be a type of spelling program. Some of the programs are too easy, and I think the program should focus less on maps, but more on improving reading skills."
"It should follow the book closer. The lab tech was very helpful to all of us in here."

"Kelly is a great teacher. He's very helpful when it comes to any questions."

"The WICAT system is very rewarding and educating."

"You should not make this a class assignment."

"I've never worked on a computer before and I love it. It's exciting and I've learned a whole lot."

"I think the WICAT center lab should stay open. It helped me a lot with my homework, and I recommend it to other students that are having problems with reading."

"I like the idea of working at my own speed. Using your Social Security number is a good idea too. I enjoyed the lab and hope to use it in the future."

"No English teacher should be allowed in lab because they talk too loud and you can't concentrate."

"WICAT helped me out."

"Keep it open to all students."

"This system is awful."

"I really believe the lab helped me to study for my class and do a better job in my class."

"When a question was incorrectly answered, it didn't explain how (why) it was incorrect. Especially in the ratio's."

"Include better examples and more practice - less graph's, more fractions and division."

"I believe that this system would be a lot better if the student could get a computer print out sheet of the activities they are working on. With the sheet, the student could review his work at a later time to help him understand the information better."

"I think that everyone should use WICAT, it will help them out."

"I had a lot of fun using WICAT."
APPENDIX B
Directions For Math Placement Test

There are two test attached. Take the test based on the amount of high school algebra you have had, including ninth grade.

Test A - Less than one year of algebra
Test B - One year or more of algebra

Directions For Answer Sheet

First Line - Print your name (Last name first)
Second Line - Check which test you are taking - A or B

Shade in the space for the correct answer with a DARK MARK.

Any erasures must be done carefully.

Test A - 25 problems
Test B - 30 problems

Tear off this page and use it for calculations. Return scrap page, booklet, and answer sheet. DO NOT WRITE ON THE TEST !!!!!!!!!!!
APPENDIX C
SELECT into don_place plt.student_id, plt.test_date, plt.math, dem.birth_date, dem.sex, dem.program_id from place_test plt, demographic dem where plt.student_id = dem.student_id and plt.test_date between 850801 and 850813;

%ppagesize 10000

select 'Y', student_id = plt.student_id, yr = t.year, sem = t.semester, course_id = t.course_id, fg = t.final_grade, birth = plt.birth_date, sex = plt.sex, pdate = plt.test_date, math = plt.math, prgcd = plt.program_id

%ppagesize 1000

select course_id, yr, sem, fg, count(*) from don_trans
group by course_id, yr, sem, fg;

%pagsize 1000

select course_id, yr, sem, fg, count(*) from don_trans1
group by course_id, yr, sem, fg;
from don_place plt, transcripts t
where plt.student_id = t.student_id
and t.course_id like 'MAT%';
SPSS/PC

DATA LIST/ ACODE 2 (A) SSN 4-12 YR 14-15 SEM 17 CLASS 23-25
AGRADE 27 (A) DUP 29 BDATE 36-37 ASEX 43 (A) PLACE
48-53 REC 55-57 PCODE 64-66 (A) RACE 70.

IF (ASEX = 'F') SEX = 1.
IF (ASEX = 'M') SEX = 2.
IF (ACODE = 'Y') CODE = 1.
IF (ACODE = 'N') CODE = 2.
<table>
<thead>
<tr>
<th>CODE</th>
<th>PROGRAM</th>
<th>SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA1</td>
<td>AIR COND. &amp; REFRIG. 1 YR</td>
<td>ARI &amp; TECH.</td>
</tr>
<tr>
<td>BC1</td>
<td>AUTO SERV. 1 YR</td>
<td>ARI &amp; TECH.</td>
</tr>
<tr>
<td>BC2</td>
<td>AUTO TECH. 2 YR</td>
<td>ARI &amp; TECH.</td>
</tr>
<tr>
<td>BE1</td>
<td>AVIATION FLIGHT TECH. 2 YR</td>
<td>ARI &amp; TECH.</td>
</tr>
<tr>
<td>BG1</td>
<td>CONST. ARCH. DRAWING 2 YR</td>
<td>ARI &amp; TECH.</td>
</tr>
<tr>
<td>BG2</td>
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5/1/82
MOTT COMMUNITY
MATHEMATICS CLASSES

Math021 - Basic Mathematics
Math101 - Beginning Algebra
Math160 - Intermediate Algebra
Math161 - College Algebra
Math163 - Plane Trigonometry
Math164 - Applied Calculus I
Math167 - Analytic Geometry and Calculus I
Math168 - Analytic Geometry and Calculus II
Math169 - Probability and Statistics
Math261 - Mathematics For Elementary Teachers I
Math267 - Analytic Geometry and Calculus III
Math268 - Differential Equations and Linear Algebra
ANALYSIS
OF
MATHEMATICS PLACEMENT PROGRAMS
IN THE
LEAGUE FOR INNOVATION COLLEGES

Resource Inventory and Directory
Compiled by
Leland J. Fry
Mathematics/Science Department
Kirkwood Community College
Cedar Rapids, Iowa

in cooperation with the League for Innovation in the Community College
QUESTIONNAIRE: Mathematics Placement Exams

1. Do you have a mathematics placement exam program?
   35 - Yes
   7 - No

2. For new students, which of the following best describes your program?
   32 - Placement exams are mandatory
   4 - Placement exams are voluntary
   6 - Other

   "During the 'rush' at registration a large percentage of our new students do not take the test. This is an extreme weakness in our program."
   "Students can request a waiver in writing—but prerequisites are always enforced."
   "Mandatory for 5+ units or any math course."
   "Mandatory for students enrolling in self-pace math course."

3. What exam/s do you use?
   15 - Locally developed exams
      Commercial standardized exams
         3 - ACT-math
         6 - CB-MAPS
         3 - SAT-Math
         9 - ACT ASSET
         3 - MAA-PTP
         2 - Other
   5 - Combination of commercial and local
   7 - Other

   New Jersey College Basic Skills Placement Test
   College Board DTMS
   CAT form ETS

4. How many types of placement exams do you give?
   6 - One only (to identify those students who need remedial courses)
   2 - One only for all courses
   3 - Two (one for the algebras and one for calculus)
   15 - Multilevel (one for each course)
   10 - Other

   "One for algebra, one for calculus, and one for math for elementary teachers."
   "One for arithmetic and one for algebra."
   "One for developmental math, one for college algebra, and one for all other courses."
   "One for pre-algebra and one for college algebra and
calculus."
"One for remedial and one for college algebra."
"Different exams for different programs."
"One for computations and one for elementary algebra."
"Three used according to high school courses completed."

5. Do you have remedial mathematics courses to place students in?

38 - Yes
0 - No

If yes, what remedial mathematics courses do you offer?

Arithmetic
High School Algebra I
High School Algebra II
High School Geometry
Elementary or Beginning Algebra
Intermediate Algebra
Personal Achievement Mathematics

6. Do students placed in your remedial courses earn credit towards graduation?

15 - Yes
21 - No

7. Do you use end-of-course exams to validate successful completion of remedial courses?

23 - Yes
14 - No

8. Approximately how many students are placed into the remedial mathematics courses annually?

Low of 100 to a high of 6000

9. Which of the following techniques do you use for predicting success in your mathematics classes?

22 - A single variable predictor
3 - A multiple regression formula predictor

10. What variables do you use to recommend a proper mathematics class for your students?

29 - Placement scores
11 - ACT-Math score
6 - CB-MAPS score
0 - ACT-Composite score
5 - SAT-Math score
2 - MAA-PTP score
19 - Number years of high school math studied
4 - High school class rank
5 - Overall high school grade point average
11 - Number of years since high school graduation
14 - Number of years since a math course was taken
1 - Identification of high school attended

11. What various course and cut-off scores do you use?

**New Jersey College Basic Skills Placement Test**
- Basic Math (2 semesters) if computation score 0-10
- Basic Math (1 semester) if computation score 11-19
- Pre-Algebra if computation score ≥ 20
- Basic Algebra if Algebra < 17

**ACT ASSET**
- Arithmetic if numerical skills ≤ 16
- Elementary Algebra if numerical skills ≥ 17

**ACT-mathematics**
- Basic Math Skills if score ≤ 12
- Elementary Algebra if score 13-15
- College level courses if score > 15

12. When do the students take the placement exams?

25 - As part of their orientation and first registration
2 - After they have accumulated 11 credit hours
0 - Before they can register in certain mathematics courses
6 - On a walk-in basis
6 - At the beginning of each term

13. Is there any difference in the way an older returning student is placed in mathematics courses from the way that a younger student is placed?

27 - No
8 - Yes. What is the difference?

"Older students sometimes prefer to take a lower level course as a refresher despite "passing" on the placement test."
"If they have a degree the placement exam is waived."
"Often voluntary placement in remedial as a brush-up and confidence builder."
"Scores haven't been good predictors for students with a long time laps."
"If student has been away for many years and comes "close" to cut-off, I recommend they "brush-up" and take the course."

14. Who administers the exams?

3 - The mathematics department
29 - The testing center
6 - The advising center
8 - Other

Learning Resource Center
Test coordinators
Learning Assistance Center
Development Center

15. When are the exams scored?

34 - For immediate feedback
6 - For delayed feedback

16. How are the exams scored?

12 - Manually
20 - Electronically
4 - Combination of both

17. How are the exam results communicated to the students?

4 - Through the mathematics staff
21 - Through the counselors
10 - Through the advising center
11 - Through the academic advisors
6 - Others

Testing Center
Scores returned to students
Learning Resources Center staff
Administrators of the test

18. Must students have department approval to enroll in any mathematics course? A prerequisite would be considered departmental approval.

24 - Yes
12 - No

19. Do you find students reluctant to take placement exams?

16 - Yes
18 - No

20. Do you have the exams available via the computer?

2 - Yes
32 - No

21. Is security of the exams a problem?

5 - Yes
30 - No

22. Do you provide sample exam questions to the students before they
take the placement exams?

24 - No
11 - Yes

23. What do you find the most successful about your program?

"More uniform mathematical background since implementation."
"In general, students are usually placed at the appropriate levels; the test appears quite valid in this respect."
"We are getting more students placed in appropriate courses."
"When the student can be tested and then interviewed by a counselor it works well."
"Students awareness of varying levels. Rationale for student success (or failure). Reasonably reliable."
"The curriculum is well-defined in the Basic Skills area. (We have about 2/3 of the students enrolled in Math 095: Basic Math, completing the course.) We devote a lot of our resources to teaching Basic Skills courses and we feel the program is pretty good. We are currently revising the Algebra part of the program and we hope to raise the completion rate. (Currently about 50%)."
"Student drops and failures in college algebra are reduced. Student frustration reduced."
"Students placed at appropriate levels tend to complete courses."
"The fact that a district that serves over 65,000 students is finally getting around to assessing skills prior to entry into courses."
"We have more homogeneous classes with higher success rate."
"We have a good working relationship with the math department."
"We maintain a high level of flexibility with our testing program and the placements based on the math test. Most students are pleased with their results."
"Better placement before students choose."
"Immediate results."
"The students are able to enroll in the appropriate course."
1) Organization of class-work and homework.
2) Specific needs of each student are met.
3) Lab is open 5 days a week 8:00 am - 7:00 pm.
   1-1 tutoring is provided by the academic staff.
4) Free hand-outs, review for tests designed by the academic staff."
"Helps to place students in a course appropriate to their ability."
"Students are placed in those units of math where there is a deficiency and are required to complete only those units which are prerequisite to the program they wish to enter. Students can proceed at their own rate."
"As an open-door institution, we owe our students a remediation process. The program assists us tremendously in providing the necessary remediation."
"The opportunity it provides for students who become lost in lecture classes to continue the study of mathematics with
reduced number of units of credit."
"The fact that students are more accurately placed in appropriate courses."
"We work with the various programs to establish specific tests to suit their needs. Likewise, the remedial math courses are program related. We are able to offer drop-in tutorial help for all students at the college who are having math or math related problems."
"Students are generally properly placed in mathematics courses. Faculty are thus far less concerned about placement."
"We have implemented a mandatory placement testing program that tests all new students (full-time) and all part-time students taking math or English. We have little resistance from students, a quick turn around time (1.5 hours), and lots of communication between faculty and assessment."
"There is good placement within the three developmental math courses. Students who have the necessary high school prerequisites still have to take the math placement test."

24. What do you find the most difficult about your program?

"Students wanting to register 'right now' without taking placement test. Students who have forgotten skills but long ago were successful in a class now recommended for them."
"Students do not seem to realize how important the test is to their placement---this is not emphasized in the introductory notice. This causes some students to appeal for retesting from their advisors."
"Adequately testing all students, late registration, last minute walk-ins, early registration."
"However, we are extremely inefficient in our testing procedures and the students are very often misplaced. Each student taking a math course is interviewed by a member of the math department, but without a test score we are not very accurate in choosing the proper direction."
"Can not test for maturity and motivation."
"Proper placement is always a problem. We try to shift students through add/drop process to place them properly. We also start our pre-algebra course three weeks after the regular semester begins to allow for 'drop-backs'. Placement is a problem in upper level courses because the NJCBSPT only tests arithmetic and elementary algebra skills. We use these modified PTP tests for upper level course, but the testing is not mandatory so they are only used at the discretion of the counselors."
"Turn-around time for scoring tests is fast, but puts testing personnel under pressure. Tests are hand-scored by dark-ages methods. Suggest that you invest in good computer scoring and placement program."
"Having enough exam instruments, physically to administer throughout our service area (9226 sq. mi.). Arranging testing for students taking alternative delivery sections (i.e. audio cassettes and correspondence at home). Finding funds to pay for the continuation for the assessment program."
test eight students per hour. We need more computers or a pencil and paper test which can be administered in the testing center."

"A common exit exam from remedial courses."

"We would like mandatory placement testing for all courses through Calculus I."

"Go to a nationally known test administered on computers. Reason: No one would question the test. If you use your own someone is always telling you about how they do it 500 miles or more away. Implication: In-house test can't be as good as a nationally know test even if it doesn't work any better than the one we use."

"More validity/reliability studies. Possibly using a multilevel exam for higher level courses. Frequently (every other semester) changing the specific items---to ensure test security."

"Better coordination between scores and background by counselors."

"A computerized assessment sheet and testing with immediate feedback is our goal."

1) Mandatory placement with appeal.
2) Computer testing with branching.
3) Multiple regression.
4) Transcripts required (Would you believe a student can take classes with a H.S. transcript.)
5) 'FLAG' prerequisites. 26% of our students are in classes without meeting the prerequisite.
6) There's more."

"More lead time available for advising before registration. Use of a meaningful placement exam to be used as a part of a total assessment of student potential and circumstances."

"MAPS (designed by Tallahassee) should be more demanding. Counselors should have more information."

"Add advanced ASSET testing in math."

"Improve the quality of the individualized learning materials. Most of the units are OK but should be updated and improved."

"I'm not sure. Perhaps we are doing the best we can given the circumstances. I would not encourage most of the students we get to go to college. The main problem is that we have too many colleges competing for too few real students. At least half of our students should either be in adult education or get an early start in the work force."

"Other than the usual minor, bureaucratic refinements that could improve any program, there are no changes worthy of note which we would like to make."

"Make the program more individualized and provide greater one-to-one student/teacher contact. Provide a means for students to discuss mathematics with a teacher or an assistant, i.e. more oral participation by the student."

"Making testing mandatory for all students, followed by enrollment in required courses immediately."

"A test center to administer the tests.
Better computer support.
Continued development of the tests, working with people or the
various programs. A college project to develop a test item data bank. Better research for establishing cut-off scores. "Send a complete sample copy of the test to students prior to testing." We have research projects evaluating the effectiveness of decision scores in English and Math. Changes will occur as a result of these studies. Also, I'd like additional arithmetic questions added to the placement test. "Allow me to test all my students in all areas." 1) Eliminate SAT and ACT math scores as a placement tool. 2) Have mandatory placement. 3) Test all transfer students.

26. Were you using placement exams three years ago?

8 - No
28 - Yes - How does that compare to the amount of testing you are doing now?
  8 - "Now doing more"
  17 - "About the same"

27. What amount and changes in testing do you anticipate in the next three years?

"Continue to improve prediction techniques."
"Currently studying tests, outcome uncertain."
"Same"
"None at this time."
"We hope to have placement exams to determine placement in Intermediate Algebra, College Algebra, Calculus I, and mathematics for business majors."
"More dependence on CAT---less students actually tested."
"We hope to increase the placement testing for our upper level courses, i.e. Intermediate Algebra, Trigonometry, Precalculus, Calculus I, and Tech Math I."
"Improvements and fine tuning."
"Anticipate same testing, but mandatory placement."
"We are currently evaluating tests, specifically the MDPT, ACT and the ACT ASSET tests."
"My hope is that the district in its collective wisdom chooses the best test to use in all 9 colleges. Then the district power structure needs to grapple with the decision of whether or not the test is mandatory or just optional."
"We will change to a commercial test."
"Not much change. We feel that our placement and testing program is meeting our needs successfully."
"Loads, mandatory placements with appeal or fight."
"We anticipate that there will continue to be an increase in testing in the next few years in view of the fact that students are being required to matriculate."
"Depends on the state legislature, I anticipate no increase in testing."
"Computer assisted testing. Refinements in current assessment."
"Hopefully we will be testing all students whether or not they have previously had a college level math course."
Responses of the League for Innovation colleges as to whether they have a placement program, the test used, and reported cut scores are listed below.

BROOKDALE COMMUNITY COLLEGE

Mandatory placement exams
Test: New Jersey Basic Skills Placement Test
   Basic Mathematics (Arithmetic, two semesters) Computation score 0-10
   Basic Mathematics (Arithmetic, one semester) Computation score 11-19
   Pre-Algebra Computation score 20-
   Basic Algebra Algebra score 0-17
See Appendix #2
Modified MAA-PTP test for upper level courses
Comment: Starts a Pre-algebra course 3 weeks after the regular semester begins to allow for "drops-backs."

CENTRAL PIEDMONT COMMUNITY COLLEGE

Mandatory placement exams
Test: Computerized Placement Tests from the College Board

CUYAHOGA COMMUNITY COLLEGE

Voluntary placement exams
Test: Locally developed test

DALLAS COUNTY COMMUNITY COLLEGE DISTRICT

El Centro

Mandatory placement exams
Test: Descriptive Tests of Mathematics Skills

Brookhaven

Mandatory placement exams
Test: Descriptive Tests of Mathematics Skills

North Lake

Mandatory placement exams
Test: Descriptive Tests of Mathematics Skills

Eastfield

Mandatory placement exams
Test: ACT-math and SAT-math
DELTA COLLEGE

No placement exams

FOOTHILL-DE ANZA COMMUNITY COLLEGE DISTRICT

Foothill

Voluntary placement exams
Test: ACT ASSET
See Appendix #3

De Anza

Mandatory placement exams
Test: SAT-math and ACT ASSET
Comment: Are in the process of implementing a computerized program.

HUMBER COLLEGE OF APPLIED ARTS AND TECHNOLOGY

Mandatory placement exams
Test: Locally developed test
Comment: Offer placement tests for academic upgrading.

JOHNSON COUNTY COMMUNITY COLLEGE

Mandatory placement exams
Test: Locally developed test

KERN COMMUNITY COLLEGE DISTRICT

No placement exams

LANE COMMUNITY COLLEGE

Mandatory placement exams
Test: Locally developed test

LOS ANGELES COMMUNITY COLLEGE DISTRICT

West Los Angeles

Voluntary placement exams
Test: Locally developed test

Trade-Technical

Mandatory placement exams
Test: ACT ASSET

The World of Numbers
College Arithmetic
Elementary Algebra

Numerical Skills 0-9
Numerical Skills 10-18
Numerical Skills 19-32
Harbor

Mandatory placement exams
Test: ACT ASSET
Arithmetic course Numerical Skills 0-16
Elementary Algebra Numerical Skills 17-32

Pierce

No placement exams

Valley

No placement exams

MARICOPA COMMUNITY COLLEGE DISTRICT

Maricopa Technical

No placement exams

Scottsdale

Mandatory placement exams
Test: CB-MAPS
Locally developed test

South Mountain

Mandatory placement exams
Test: CB-MAPS and ACT ASSET

Phoenix

Mandatory placement exams
Test: Locally developed test
Pilot testing ACT ASSET and CB-MAPS

Rio Salado

Mandatory placement exams
Test: CB-MAPS and ACT ASSET
Cut-off scores based on national norms

Mesa

Mandatory placement exams
Test: Locally developed test
Pilot testing ACT ASSET and CB-MAPS
MIAMI-DADE COMMUNITY COLLEGE

Mandatory placement exams
Test: Florida MAPS and CGP
See Appendix #4

MONROE COMMUNITY COLLEGE

No placement exams

MORAINE VALLEY COMMUNITY COLLEGE

Mandatory placement exams
Test: Locally developed test

PERALTA COMMUNITY COLLEGE DISTRICT

Feather River

Mandatory placement exams
Test: Descriptive Tests of Mathematics Skills
Remedial
Arithmetic Skills ≤ 80%
Algebra exempt
Comprehensive ≥ 50%

Merritt

Mandatory placement exams
Test: ACT ASSET

College of Alameda

Voluntary placement exams
Test: Locally developed test

SANTA FE COMMUNITY COLLEGE

Mandatory placement exams
Test: ACT-math
Basic Math Skills
Elementary Algebra
College level courses
ACT-math score 0-12
ACT-math score 13-15
ACT-math score 16-

ST. LOUIS COMMUNITY COLLEGE

Meramec

Mandatory placement exams
Test: Locally developed test
MAA-PTP

Forest Park

Mandatory placement exams
Test: Locally developed test
Florissant Valley

Mandatory placement exams
Test: Locally developed test
KIRKWOOD COMMUNITY COLLEGE'S MATHEMATICS' PLACEMENT PROGRAM

During the fall quarter, 1985, we began pilot testing exams. Students in our Beginning Algebra, Intermediate Algebra, College Algebra, and Calculus I were tested at the beginning of the quarter. The tests used were:

1) Mathematical Association of America Placement Testing Program exams
   a. A-SK parts I and II
   b. Arithmetic and Basic Skills Test
   c. A-Algebra Test
   d. CR-Calculus Readiness

2) ACT ASSET
   a. Numerical Skills
   b. Elementary Algebra
   c. Intermediate Algebra
   d. College Algebra

3) ACT-math Assessment

(For a complete list of what exams we used in each particular course see Appendix #5.) A total of 446 students were tested during this quarter, 333 Algebra students and 113 Calculus I students.

During the 1985-86 winter quarter we tested 227 students in our Beginning and Intermediate Algebra classes. This time we used only the Mathematical Association of America's BA-Basic Algebra exam.

Spring quarter, 1986, the mathematics faculty with the assistance of Dr. James Maxey, Senior Research Scientist and Research Director at American College Testing, Iowa City, Iowa and his staff, along with material from the Mathematical Association of America's Placement Testing Program, determined appropriate cut scores for our mathematics classes. Using information gathered from a mathematics placement questionnaire (see appendix #6) that our students were asked to fill out, we developed the final criteria to be used in placing new students in an appropriate mathematics class.

A testing manual was developed for all sites that Kirkwood Community College serves in our seven-county area. The manual contains placement philosophy of the mathematics staff, guidelines for determining who is to be tested, criteria for placement, a placement chart, a set of exams, solution keys, and a form to report the scores to the student and also the advising center. (See Appendix #7.)
LEAGUE FOR INNOVATION
IN THE COMMUNITY COLLEGE

In order to improve instruction in our mathematics courses and increase retention of our students, Kirkwood Community College received a Title III grant to establish a mathematics placement exam program. With the funds we are to develop/select mathematics course-placement exams, pilot the exams and determine the best criteria to assist our students in selecting the correct level of mathematics at which to begin their study.

To set up the best system we can design, we are looking at models at other colleges. This study of other programs will give us more insight into many of the questions that must have answers that fit Kirkwood's situation and student population, questions such as:
- Is one exam sufficient or will we need a multilevel system?
- What are the best variables other than placement scores to include in our predictor formula for proper placement?
- Are sample exams beneficial to give to the students before they take the actual placement exam?

And there are many more questions. With the information we receive from this questionnaire, we can better determine which exams are the best predictors of success in our various mathematics courses.

So far, during the spring and summer quarters of 1985, we have pilot tested a computerized adaptive testing program for Educational Testing Service and have been collecting data from it. During the fall quarter, 1985, we are using three exams: ACT-math, ACT's ASSET, and the Mathematical Association of America's FTP exams. With this data and information from a biographical mathematics questionnaire we will then begin to determine which exams, what cut-off scores and other variables will give us the best results for predicting a student's success in a mathematics course.

Thus, what we are requesting from you is the completion of the enclosed questionnaire and the sharing of mathematical exam brochures, pamphlets, and any forms that you use.

Thank you for your time and consideration of this request.
QUESTIONNAIRE: Mathematics Placement Exams

Please mark all responses that you feel are appropriate to your testing program. If more than one response applies, please mark them. If you have any questions feel free to contact me.

Leland J. Fry
Math/Science Department
Kirkwood Community College
6301 Kirkwood Blvd SW
Cedar Rapids, IA 52406
Phone: (319) 398-5417

1. Do you have a mathematics placement exam program?

   ___ Yes
   ___ No  (Please answer question #27 on page 5)

2. For new students, which of the following best describes your program?

   ___ Placement exams are mandatory
   ___ Placement exams are voluntary
   ___ Other ________________________________

3. What exam/s do you use?

   ___ Locally developed exams
   ___ Commercial standardized exams
      ___ ACT-Math
      ___ CB-MAPS
      ___ SAT-Math
      ___ ACT ASSET
      ___ MAA-PTP (A-SK, BA, AA, A, T, CR)  Please Circle other ________________________________
   ___ A combination of commercial and local
   ___ Other ________________________________

4. How many types of placement exams do you give?

   ___ One only (to identify those students who need remedial courses)
   ___ One only for all courses
   ___ Two (one for the algebras and one for calculus)
   ___ Multilevel (one for each course)
   ___ Other ________________________________

5. Do you have remedial mathematics courses to place students in?

   ___ Yes
   ___ No

If yes, what remedial mathematics courses do you offer?

________________________________________________________________________

________________________________________________________________________
6. Do students placed in your remedial courses earn credit towards graduation?
   ____ Yes
   ____ No

7. Do you use end-of-course exams to validate successful completion of remedial courses?
   ____ Yes
   ____ No

8. Approximately how many students are placed into the remedial mathematics courses annually? _____________

9. Which of the following techniques do you use for predicting success in your mathematics classes?
   ____ A single variable predictor
   ____ A multiple regression formula predictor

10. What variables do you use to recommend a proper mathematics class for your students?
    ____ placement scores
    ____ ACT-Math score
    ____ CB-MAPS score
    ____ ACT-Composite score
    ____ SAT-Math score
    ____ MAA-PTP score
    ____ number of years of high school math studied
    ____ high school class rank
    ____ overall high school grade point average
    ____ number of years since high school graduation
    ____ number of years since a math course was taken
    ____ identification of high school attended
    ____ others ________________

11. What various course and cut-off scores do you use?
    ____________________________________________________________
    ____________________________________________________________

12. When do the students take the placement exams?
    ____ As part of their orientation and first registration.
    ____ After they have accumulated ____ credit hours.
    ____ Before they can register in certain mathematics courses?
      Which ones? ________________________
    ____ On a walk in basis.
    ____ At the beginning of each term.
    ____ Other ________
13. Is there any difference in the way an older returning student is placed in mathematics courses to the way that a younger student is placed?

___ No
___ Yes  What is the difference? _____________________________

14. Who administers the exams?

___ The mathematics department
___ The testing center
___ The advising center
___ Other _____________________________

15. When are the exams scored?

___ For immediate feedback
___ For delayed feedback

16. How are the exams scored?

___ Manually
___ Electronically
___ Combination of both

17. How are the exam results communicated to the students?

___ Through the mathematics staff
___ Through the counselors
___ Through the advising center
___ Through the academic advisors
___ Other _____________________________

18. Must students have department approval to enroll in any mathematics course? A preprerequisite would be considered departmental approval.

___ Yes
___ No

19. Do you find students reluctant to take placement exams?

___ Yes
___ No

20. Do you have the exams available via the computer?

___ Yes
___ No

21. Is security of the exams a problem?

___ Yes
___ No
22. Do you provide sample exam questions to the students before they take the placement exams?

   _____ No
   _____ Yes

23. What do you find the most successful about your program?

24. What do you find the most difficult about your program?

25. What changes would you like to make right now in your program?
26. Were you using placement exams three years ago?

____ No
____ Yes - How does that compare to the amount of testing you are doing now?

27. What amount and changes in testing do you anticipate in the next three years?

Thank you for your time and consideration of this questionnaire. Could I have the name, school, and phone number of the person filling out the questionnaire so that if I have any questions I could contact them personally.

Respondent: ____________________________________________

School: ________________________________________________

Phone: (___) __________________

Date: _____________________
<table>
<thead>
<tr>
<th>COURSE</th>
<th>MINIMUM PREREQUISITES</th>
<th>ADDITIONAL CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Math 091</td>
<td>Score of 0 - 10 on computation section of NJCBSPT.</td>
<td>Retesting in the Testing Center is possible if there is reason to question the validity of the original score.</td>
</tr>
<tr>
<td>3 hrs/no credit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Math 092</td>
<td>Successful completion of 091 or partial completion of 095 and written instructor's recommendation.</td>
<td></td>
</tr>
<tr>
<td>3 hrs/no credit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Math 095</td>
<td>Score of 11 - 19 on computation section of NJCBSPT.</td>
<td>Students who score 20 - 23 on the computation test may need math 095 if their degree objectives require strong arithmetic skills.</td>
</tr>
<tr>
<td>4 hrs/no credit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Algebra 096</td>
<td>Score of at least 20 on computation section of NJCBSPT or successful completion of math 092 or 095 and no previous algebra background.</td>
<td>Students whose last algebra course was so long ago that few skills have been retained or recent high school grads who score under 10 on the algebra section of NJCBSPT may need math 096 before attempting math 118.</td>
</tr>
<tr>
<td>2 hrs/no credit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary Algebra 118</td>
<td>Computation requirements satisfied; successful completion of math 096 or some prior algebra experience but score on algebra section on NJCBSPT below 17.</td>
<td>Students who plan to take math 137 (finite), 151 (intermed. alg), or 161 (tech. math) should consider math 118 if algebra score is between 17 and 21 (referral range) since greater competence in elementary algebra is assumed in these courses.</td>
</tr>
<tr>
<td>3 credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistics 131</td>
<td>Completion of, or exemption from, basic math and elementary algebra requirements.</td>
<td>Recommended for liberal arts, social science and education majors.</td>
</tr>
<tr>
<td>4 credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fundamental Concepts 136</td>
<td>Elementary algebra</td>
<td></td>
</tr>
<tr>
<td>3 credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finite Math 137</td>
<td>Elementary algebra</td>
<td>Good and current algebra and graphing skills are required; students who score 17 - 21 on the algebra section of NJBSPT might be referred to math 118. This course is recommended for business students.</td>
</tr>
<tr>
<td>3 credits</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Advising Recommendations Based on Assessment Results

<table>
<thead>
<tr>
<th>Skill Area</th>
<th>Number Correct</th>
<th>% of HS Seniors</th>
<th>Course Recommendations by Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerical Skills</td>
<td></td>
<td></td>
<td>Arithmetic Fundamentals</td>
</tr>
<tr>
<td></td>
<td>0 - 17</td>
<td>32% (Low 40%)</td>
<td>Business Computation Fundamentals</td>
</tr>
<tr>
<td></td>
<td>18 - 20</td>
<td>37%</td>
<td>Introductory Technical Math</td>
</tr>
<tr>
<td></td>
<td>21 - 32</td>
<td>52% (Top 60%)</td>
<td>Decision Zone</td>
</tr>
<tr>
<td></td>
<td>33 - 40</td>
<td>100%</td>
<td>Elementary Algebra, Accounting, Technical courses requiring basic arithmetic foundation</td>
</tr>
<tr>
<td>Elementary</td>
<td>0 - 12</td>
<td></td>
<td>Elementary Algebra (if Numerical Skills score is less than 21, follow Numerical Skills recommendations)</td>
</tr>
<tr>
<td>Algebra</td>
<td></td>
<td></td>
<td>Decision Zone</td>
</tr>
<tr>
<td></td>
<td>13 - 15</td>
<td></td>
<td>Intermediate Algebra</td>
</tr>
<tr>
<td></td>
<td>16 - 25</td>
<td></td>
<td>College Algebra</td>
</tr>
<tr>
<td>Intermediate</td>
<td>0 - 12</td>
<td></td>
<td>Intermediate Algebra</td>
</tr>
<tr>
<td>Algebra</td>
<td></td>
<td></td>
<td>Decision Zone</td>
</tr>
<tr>
<td></td>
<td>13 - 15</td>
<td></td>
<td>College Algebra</td>
</tr>
<tr>
<td></td>
<td>16 - 25</td>
<td></td>
<td>Decision Zone</td>
</tr>
<tr>
<td>College</td>
<td>0 - 12</td>
<td></td>
<td>College Algebra</td>
</tr>
<tr>
<td>Algebra</td>
<td></td>
<td></td>
<td>Decision Zone</td>
</tr>
<tr>
<td></td>
<td>13 - 15</td>
<td></td>
<td>Calculus</td>
</tr>
<tr>
<td></td>
<td>16 - 25</td>
<td></td>
<td>Calculus</td>
</tr>
</tbody>
</table>

**NOTE:** If your score falls in a "Decision Zone", you will need to decide which direction you will want to go. Your skills appear to be on the borderline in terms of your readiness for the higher course. The lower level course would offer a good review and skill building experience. If you should choose the higher course, you will find that you must apply good study skills and probably more time than other students to be successful. You may wish to discuss your options with a counselor before you make your decision.
<table>
<thead>
<tr>
<th>Test</th>
<th>MAPS Form A (Before 7-1-85) Raw Score</th>
<th>MAPS Form B (After 7-1-85) Raw Score</th>
<th>CGP Raw Score</th>
<th>Course Placement</th>
<th>Required Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test of Standard Written English</td>
<td>0 - 7</td>
<td>0 - 7</td>
<td>0 - 10</td>
<td>ENC 0006</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td>8 - 18</td>
<td>8 - 16</td>
<td>11 - 16</td>
<td>ENC 0007</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td>19 - 24</td>
<td>17 - 23</td>
<td>17 - 21</td>
<td>ENC 1100</td>
<td>Recommended</td>
</tr>
<tr>
<td></td>
<td>25+</td>
<td>24+</td>
<td>22+</td>
<td>ENC 1101</td>
<td>Required</td>
</tr>
<tr>
<td>Reading</td>
<td>0 - 16</td>
<td>0 - 16</td>
<td>0 - 11</td>
<td>REA 0001</td>
<td>Required (Must see academic advisor)</td>
</tr>
<tr>
<td></td>
<td>17 - 26</td>
<td>17 - 27</td>
<td>12 - 18</td>
<td>REA 0002</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td>27 - 30</td>
<td>28 - 31</td>
<td>19 - 21</td>
<td>REA 1105</td>
<td>Recommended</td>
</tr>
<tr>
<td>If Arithmetic and Algebra</td>
<td>0 - 25</td>
<td>0 - 23</td>
<td>0 - 20</td>
<td>MAT 0003</td>
<td>Required (1)</td>
</tr>
<tr>
<td>If Arithmetic and Algebra</td>
<td>0 - 13</td>
<td>0 - 13</td>
<td>0 - 19</td>
<td>MAT 0024</td>
<td>Required</td>
</tr>
<tr>
<td>If Arithmetic and Algebra</td>
<td>26+</td>
<td>24+</td>
<td>21+</td>
<td>MAT 0024</td>
<td>Required</td>
</tr>
<tr>
<td>and Algebra</td>
<td>0 - 13</td>
<td>0 - 13</td>
<td>0 - 19</td>
<td>MAT 1033</td>
<td>Required</td>
</tr>
<tr>
<td>and Algebra</td>
<td>14 - 18</td>
<td>14 - 17</td>
<td>20+ (2)</td>
<td>MAT 1033</td>
<td>Required (2)</td>
</tr>
<tr>
<td>and Algebra</td>
<td>19+</td>
<td>18+</td>
<td>20+</td>
<td>MAT 1033 or higher</td>
<td>See note (3)</td>
</tr>
</tbody>
</table>

Students scoring 840 or better on the SAT or 17 or better on the ACT will be exempt from writing the Florida MAPS.

(1) Students falling below the passing score in both Computation and Algebra MUST take MAT 0003 and MAT 0024 either sequentially or concurrently.

(2) Algebra scores are not required for students writing the CGP prior to November 1, 1985. Continuing students who have CGP scores and elect not to write the Algebra Test must take MAT 0024 (Introductory Algebra).

(3) Math placement for students scoring 18+ on MAPS (Form B, 19 Form A) depends upon the student's major, previous coursework in mathematics, and transfer program (see appropriate AA grid).

ab
10/85
MATHEMATICS PLACEMENT EXAMS: Fall quarter

Beginning Algebra
ASSET
Numerical Skills (18 minutes)
Elementary Algebra (25 minutes)

ACT-math (50 minutes)

MAA-PTP
A-SK parts I and II
Arithmetic and Basic Skills test (40 minutes)

Intermediate Algebra
ASSET
Elementary Algebra (25 minutes)
Intermediate Algebra (25 minutes)

ACT-math (50 minutes)

MAA-PTP
A-Alg Exam
Combined basic and advanced algebra (45 minutes)

College Algebra
ASSET
Intermediate Algebra (25 minutes)
College Algebra (25 minutes)

ACT-math (50 minutes)

MAA-PTP
A-Alg Exam
Combined basic and advanced algebra (45 minutes)

Calculus I
ASSET
College Algebra (25 minutes)

ACT-math (50 minutes)

MAA-PTP
CR--Calculus Readiness Exam (35 minutes)
KIRKWOOD COMMUNITY COLLEGE

MATHEMATICS PLACEMENT QUESTIONNAIRE

NAME: ____________________________  S.S. #: ____________

1. What year did you graduate from high school? ______

2. What was your class rank in high school? [If you are not sure
give your best estimate.]
   - Top quarter ______
   - Second quarter ______
   - Third quarter ______
   - Fourth quarter ______

3. What was your overall high school grade point average?
   - A (3.5-4.0) ______
   - B (2.5-3.4) ______
   - C (1.5-2.4) ______
   - D (0.5-1.4) ______

4. How many years has it been since you took a math course? ______

5. What was the course grade in your most recent math course?
   - A ______
   - B ______
   - C ______
   - D ______
   - F ______

   What was this course? ____________________________

   Was this in high school? ______ college? ______

6. How many years of high school mathematics did you take? ______

7. Which of the following courses did you take in high school?
   - Beginning algebra ______
   - Geometry ______
   - Second year algebra ______
   - Trigonometry ______
   - Elementary analysis ______

8. What additional mathematics courses do you plan to take while
   at Kirkwood?

   ____________________________
   ____________________________
   ____________________________

9. Do you plan to transfer to a four year institution?
   - yes ______
   - no ______

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Mathematics
Placement
Program

\[ e^{\pi i} = -1 \]

Title III
MATHEMATICS PLACEMENT BEGINS

Beginning with new students registering for Kirkwood's 1986 fall quarter and thereafter, a registration in a student's first college mathematics course will require a mathematics placement score. This placement score may be either an ACT-mathematics score, an ASSET score, or a Mathematical Association of America's exam score. The Mathematical Association of America's exam will be administered at Kirkwood for any student that does not have a ACT or ASSET score. There is no charge for this exam.

Any returning student that has attended classes at Kirkwood prior to fall of 1986, is not required to have mathematics placement scores. However, if they have not taken a college mathematics course, we strongly recommend that they take advantage of the placement service.

If you have any questions about the placement program please contact Leland J. Fry, phone 5417. Brochures are being printed and should be available around the first of May.
KIRKWOOD COMMUNITY COLLEGE

MATHEMATICS PLACEMENT PROGRAM

The mathematics faculty at Kirkwood Community College is dedicated to the statement, "A student's first mathematics course at Kirkwood Community College should develop self-confidence in the ability to do mathematics, increase the knowledge of mathematics, improve the ability to formulate questions, and give the opportunities to use these in solving problems. Hence, a student's first placement in a mathematics course is of utmost importance.

How can we guarantee the student that they are in the proper mathematics course? We can't, but we will do our best to properly place a student in a course that the faculty and the student feel will benefit them the most. Proper placement of a student is of mutual benefit to the student and the faculty because it will:

1. Result in a class where students will have basically the same mathematical background.
2. Give the student a better chance to succeed in the course.
3. Improve the student's mathematical background.
4. Enhance the student's chances of succeeding in future courses.

Student placement at Kirkwood is based on the following criteria:

1. High school (grades 9-12) mathematics taken
   LEVEL I: No high school algebra or one year but it has been a long time. (i.e. more than three years)
   LEVEL II: Algebra I content (one year)
   LEVEL III: Algebra I & II content (two years)
   LEVEL IV: Three years of math including two and one half years of algebra content and some trigonometry.
   LEVEL V: Four or more years of college prep mathematics.
2. The grade that you received in your last mathematics course.
3. A score on one of the following exams:
   ACT-Assessment math
   ASSET
   Mathematical Association of America's Placement Testing Program exam
If you have taken any of these exams, please bring a copy of the scores with you when you come to register. If you do not have any of the above exam scores and you are in one of the following categories, then you MUST take a placement exam.

1. All first-time-in-college degree-seeking students.
2. All students registering for their first college mathematics course.

The mathematics faculty wish to thank you for considering Kirkwood Community College in your educational plans. Remember that at Kirkwood, highly qualified faculty are available to assist you in determining which course would be appropriate for you at each stage of your education. We are sincerely interested in you and hope you succeed in this educational endeavor.

INFORMATION YOU WILL NEED TO CONSIDER WHEN YOU REGISTER FOR A MATHEMATICS COURSE AT KIRKWOOD

Please fill in all of the following that you can and bring this with you when you come to register.

1. The LEVEL of high school mathematics as indicated on the placement chart on the next page.

2. ACT-Assessment mathematics score.

3. ASSET scores. Numerical Skills
   Elementary Algebra
   Intermediate Algebra
   College Algebra

4. Number of years since an algebra or higher math course was completed.

5. How you felt about your last mathematics course. Easy
   So-so
   Difficult

6. What was your grade in that last math course?

7. What are your overall goals in taking a mathematics class? Only need one
   Need through Statistics
   Need through Calculus

8. Courses you are considering taking this quarter
   CORE NEEDED Communication Arts
   Humanities
   Social Science
   Math/Science
   Historical/Cultural

9. Number hours per week you plan to work.
<table>
<thead>
<tr>
<th>School Mathematics</th>
<th>Last Math Grade</th>
<th>ACT-math</th>
<th>MAA-PTP</th>
<th>ASSET</th>
<th>Recommended Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEVEL I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No algebra or one year but it has been a long time</td>
<td>0-11 (Should take another test)</td>
<td>BA</td>
<td>3-4</td>
<td>17-18</td>
<td>6-7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0-2</td>
<td>19-32</td>
<td>8-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5-8</td>
<td>19-32</td>
<td>8-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12-13</td>
<td>9-10</td>
<td>0-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEVEL II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebra I content (one year)</td>
<td>14-18</td>
<td>Intermediate Algebra</td>
<td>11-14</td>
<td>7-12</td>
<td>13-25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEVEL III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebra I &amp; II content (two years)</td>
<td>21-25</td>
<td>College Algebra</td>
<td>17-25</td>
<td>15-25</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEVEL IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two and one half years of algebra content and some trig</td>
<td>23-25</td>
<td>CR</td>
<td>0-9</td>
<td>9-11</td>
<td>12-13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0-9 (Take BA exam)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>LEVEL V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four years of College prep</td>
<td>26-27</td>
<td>12-25</td>
<td>10-11</td>
<td>14-25</td>
<td>12-13</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
*** DECISION SCORES: Scores on exams where data is not clear cut as to what course LEVEL a student should enroll at Kirkwood.

HOW TO DETERMINE PROPER PLACEMENT

Using the placement score and the information you provided about yourself, first locate your LEVEL of high school mathematics on the placement chart, move across that LEVEL until you reach the exam column for which you have a placement score. If your placement score is within the indicated range, then the mathematics course we recommend you take will be in the right hand column.

If your placement score is not in the indicated range, then you must consider one of three situations:

1. Placement score less than your LEVEL: Means you probably need review and should take the course in the LEVEL in which your placement score lies.

2. Decision Score: Your skills appear to be on the borderline in terms of your readiness for the higher LEVEL course. The lower LEVEL course would offer a good review and skill building experience. If you choose the higher LEVEL course, you will find that you must apply good study skills and probably more time than other students to be successful.

3. Placement score greater than your LEVEL: Means you may have the necessary skill and knowledge to take the course in the LEVEL in which your placement score lies.

Because data cannot guarantee proper placement, we feel that the student should have input in determining the course LEVEL that is appropriate. Factors you should examine in making your decision are:

1. Number of credit hours you plan to take during the quarter.
2. The number of hours per week you work.
3. Family responsibilities.
4. Outside activities.
5. The amount of time that has elapsed since your last mathematics course. [The skills of mathematics deteriorate rapidly with the passage of time.]
6. The grade you received in your most recent mathematics course. [If it was a D or F and possibly a low C, you should consider taking a lower LEVEL course.]
7. You are typically expected to spend 2-4 hours studying outside of class for every hour spent in class.
8. Understanding mathematics is much easier if you spread your studying out over the week, studying it each day.

You may wish to discuss your options with a counselor or advisor before you make your decision.
Kirkwood Community College
TITLE III TESTING SCORES

Date ______________________  Time ______________________
Proctor ______________________
Site ______________________

Student ______________________
Social Security No ______________________

☐ AA  ☐ Career Option
☐ Voc-Tech taking transfer courses and haven’t taken ASSET

ACT English score ........................................
KCC English score ........................................
ASSET Language Usage ..........................

Based on this score, the student may enroll in the courses checked below
☐ CM324T ELEMENTS OF WRITING
☐ CM101T COMPOSITION I
☐ CM102T COMPOSITION II
☐ Testing requirement is waived because the student has completed the appropriate writing course.
☐ PERSONAL ACHIEVEMENT WRITING recommended

High school math level ☐ I ☐ II ☐ III ☐ IV ☐ V

ACT Math score ........................................

MAA PTP score ........................................ BA

MAA PTP score ........................................ Fr

ASSET Numerical Skills ..........................

ASSET Elementary Algebra ..........................

ASSET College Algebra ..........................

Based on the above information the mathematics staff recommend that the student enroll in the course checked below

☐ MA020D BEGINNING ALGEBRA
☐ MA011T INTERMEDIATE ALGEBRA
☐ MA051T COLLEGE ALGEBRA
☐ MA041T STATISTICS
☐ MA051T BUSINESS CALCULUS
☐ MA032T PRECALCULUS I

☐ MA033T PRECALCULUS II
☐ MA034T PRECALCULUS III
☐ MA035T CALCULUS I

I do not intend to follow the mathematics staff’s recommendation

........................................ Student’s signature

This is a three part form:
1) Advising Center copy
2) Site copy
3) Student copy
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132, Sample Mathematics Test BA
133, Sample Mathematics Test Cr

University Microfilms International
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Stonehocker, Loya (1985). "Institutional Response to Student Skill needs at Grande Prairie Regional College." ERIC.

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ABSTRACT

A VALIDITY ASSESSMENT OF A MATHEMATICS PLACEMENT TEST USED WITH ENTERING STUDENTS AT MOTT COMMUNITY COLLEGE

BY

EULA M. SPANN-KIRK

DECEMBER 1991

ADVISOR: Donald Marcotte

MAJOR: Curriculum and Instruction

DEGREE: Doctor of Education

Mott Community College (MCC) has an open door policy that permits any student graduating from high school, or 19 years old or older, to be admitted. Once admitted, students must take a mathematics placement test before enrolling in classes. In the Fall Semester, 1985, the testing cut-off date did not allow enough time for all students applying for admission to be tested. Therefore, in order to accommodate the students, MCC allowed 239 students to take classes without taking the mathematics placement test. The subjects for this study consisted of 239 First Time In Any College (FTIAC) students at MCC who took the mathematics placement test and 239 FTIAC students who did not take the mathematics placement test during the Fall semester 1985. This study will examine the following: 1) Did the students who took the mathematics placement test take the advised mathematics class? 2) Does the mathematics placement test taken before entrance to MCC accurately place students in mathematics classes? 3) Is there a
difference in the final grades among students who took the mathematics placement test and took the recommended courses, who took the mathematics placement test and did not take recommended courses, and who did not take the mathematics placement test? 4) Does the mathematics placement test predict the students’ overall academic achievement in mathematics? 5) Does successful placement of students in mathematics classes make a difference in the retention rate of students in mathematic classes?

This study has presented the summary and conclusions of the validity of the mathematics placement at MCC. Students who did not take the mathematics placement test, which was a one-time only occurrence Fall Semester, 1985, and students who did not follow recommended coursework, did as well or, in some cases, better than students who took the mathematics placement test and followed the recommended coursework. These results indicate that the mathematics faculty of the college needs to re-examine the validity and reliability of the mathematics placement test, as well as its scoring.
AUTOBIOGRAPHICAL STATEMENT

EULA M. SPANN-KIRK

EDUCATION:  
Ed.D., Wayne State University, Detroit, MI.  
Major: Curriculum and Instruction, Minor:  
Educational Research, 1991  
M.A., Central Michigan University, Mt. Pleasant, MI, 1981  
Major: Business Management, Minor: Computer Science  
B.S., Oakland University, Rochester, MI 1975,  
Major: Business Management  
A.A.S., Oakland Community College, Farmington, MI, 1972, Major: Computer Science

OCCUPATIONAL HISTORY:  
1981-Present Director, Information Systems, Mott Community College, Flint, MI.  
1976-81 Director, Computer Center, Detroit Institute of Technology, Detroit, MI  
1976-81 Part-time Computer Instructor, Oakland County Community College, Farmington, MI  
1976-81 Part-time Computer Instructor, Wayne County Community College, Detroit, MI  
1966-74 Programmer/Analyst, General Motors, Pontiac, MI.

PROFESSIONAL ORGANIZATIONS: Michigan Education Association for Data Systems, National Prime Users Group, National ShareBase Users Group