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Predictors of Academic Success for High School Students: The Correlation between Middle School Missouri Assessment Program Scores and Freshman Year Grade Point Average

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DECLARATION OF ORIGINALITY

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work here at Lindenwood University and that I have not submitted it for any other college or university course or degree here or elsewhere.

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PREDICTORS OF ACADEMIC SUCCESS FOR HIGH SCHOOL STUDENTS: THE CORRELATION BETWEEN MIDDLE SCHOOL MISSOURI ASSESSMENT PROGRAM SCORES AND FRESHMAN YEAR GRADE POINT AVERAGE

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Abstract

Educators lack an efficient means to predict academic success at the high school level. Analysis of assessment scores may provide prediction patterns to help districts raise the percentage of students who persist to graduation, provide support for students who exhibit characteristics of academic risk or giftedness, and move populations closer to meeting Adequate Yearly Progress. To consider assessment data as potential indicators of academic transition success from middle to high school, this study examined the correlation between middle school Missouri Assessment Program (MAP) scores and high school Grade Point Average (GPA). MAP Communication Arts and Mathematics were independent variables. The dependent variable was cumulative freshman-year GPA.

Stepwise multiple regression analysis determined a positive correlation between each independent variable and freshman-year GPA. Calculation of the Pearson Coefficient determined that MAP Mathematics demonstrated the strongest relationship. A logistic regression analysis was used to investigate the value of MAP Communication Arts and Mathematics scores as predictors of the range of GPA likely to be achieved. Using conditional probabilities, a prediction model was constructed and applied to analyze characteristics of data across a two-year time span. Preliminary identification of student MAP achievement in the Advanced and Proficient categories allowed a comparison to the subsequent GPA range. Ranges were defined by dividing the traditional 4.0 GPA into five categories.

Scores in the Advanced and Proficient ranges from each MAP category yielded an excellent accuracy rate for predicting a GPA of 2.5 & above, and a strong accuracy rate for predicting a GPA of 3.0 & above. The Mathematics and Communication Arts

categories demonstrated an excellent prediction success rate for the GPA category of 3.5 & above. Results indicate that educators may benefit from adding middle school MAP Mathematics scores to the portfolio when evaluating strengths and weaknesses relative to academic transition to high school. Before deciding upon the usefulness of this tool, a district would benefit from a similar examination of its own data. Factors not considered in this study, such as choice of school improvement model (Professional Learning Community vs. Accelerated Schools) and type of scheduling (block vs. traditional), may yield differing results district-to-district.

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KEY TO ABBREVIATIONS

AYP	Adequate Yearly Progress
ACT	American College Test
CAR	Category Accuracy Rate
CA	Communication Arts
ΔCAR	Increased Category Accuracy Rate
DOE	United States Department of Education
GLE	Grade Level Expectation
GPA	Grade point average
HSAV	High School Grade Point Average
HQT	Highly Qualified Teacher
LEA	Local Education Agency
MA	Mathematics
MAP	Missouri Assessment Program
MO DESE	Missouri Department of Elementary and Secondary Education
NCLB	No Child Left Behind Act
OSA	Oregon State Assessment
R	Correlation Coefficient
R^2	Coefficient of Determination
SAT	Scholastic Achievement Test
SIS	School Information System
SR	Success Rate

CHAPTER ONE – INTRODUCTION

Background of the Problem

Universities, colleges, and private high schools have admission criteria to guide recruitment of successful students. Admission policies help maintain an institution's reputation which is frequently gauged by academic performance measured by grade point average, scores on standardized assessments such as the American College Test (ACT), Scholastic Achievement Test (SAT), or Advanced Placement (AP) exams; or an inventory of academic activities pursued (Matthews, 2008b; "The Top", 2008).

Private schools and exclusive public schools, with a limited number of available seats, can refuse admission to the student defined as less talented than his or her peers indicated by lower class rank and lower SAT, ACT, or AP scores. For example, a student was expelled from Thomas Jefferson High School for Science and Technology in Virginia for failure to maintain a minimum cumulative grade point average (GPA). The student was expelled " . . . following his completion of the tenth grade with a B-minus average, as internal policy now requires students earn at least a 3.0 GPA to remain at the selective school" (Eye on Curriculum, 2008c, p. 1). In reference to this same incident, "A check of other nationally prominent magnets found six with no minimum, two with a 2.0 minimum and one with a 2.5 minimum" (Matthews, 2008a, p. B01). So, some schools are measuring student academic success with cumulative grade point average and enforcing consequences for students who fail to meet the required minimum.

Public high schools accept the challenge of providing an optimal education to student enrollments representing varied backgrounds, talents, and skill levels. Programming, planning, and staffing within the financial constraints of a district can pose difficult choices as administrators strive to provide an appropriate educational setting for their individual communities. Priorities are set and decisions are made concerning which programs, classes, and materials fit student body needs, as well as the financial budget for the year. Decision making and priority setting are easier when proper data and information are gathered concerning district offerings and student needs.

It seems to be the expectation and task of the public school district to place the academic, cognitive, and social development of the student in the number one priority position. Since the implementation of the No Child Left Behind Act (NCLB) in 2002, districts withstand increased public scrutiny and pressure to provide measureable academic achievement. The No Child Left Behind Act (NCLB) provides the measure of improved academic achievement through its demand for Adequate Yearly Progress (AYP) from each individual school and district (United States Department of Education [DOE], 2008b). "Under No Child Left Behind, each state has developed and implemented measurements for determining whether its schools and local educational agencies (LEAs) are making adequate yearly progress (AYP)" (DOE, AYP section, ¶ 1).

Consequences for failing to meet the assigned level of AYP include the district's placement on a state-initiated school improvement plan (DOE, 2008a). The criteria for placement in, and removal from, the school improvement mode are specifically outlined. Each state has designed its own assessment process, criteria for placement, and categorization process for each level of school improvement to which a district may be

assigned (DOE, 2008b). The No Child Left Behind Act (NCLB) mandates that districts will exhibit measureable progress toward AYP, but the process and consequences are provided under individual state jurisdiction.

Missouri has identified guidelines for the state's pathway to improved student academic achievement. State-wide success will depend on " . . . continued commitment to the following core principles: High Standards, Annual Assessments, Accountability for Results, Highly Qualified Teachers in Every Classroom (HQT), Information and Options for Parents, and All Children on Grade Level By 2014" (DOE, 2008a). Efforts to place highly qualified teachers in Missouri classrooms are linked to state teacher certification requirements. Progress in meeting the goal to guide all children to grade-level status is measured yearly through the use of state-designed assessments. Accountability for results is tied to placement on a state-designed school improvement program for failure to meet AYP. Missouri has outlined curriculum goals, expectations for school districts, and accountability consequences as mandated through NCLB.

In order to pursue high academic achievement, educators could employ strategies to include (a) alignment of classroom curriculum with state guidelines; (b) vertical alignment of curriculum within Kindergarten through 12th grade (K-12) district offerings; and (c) implementation of appropriate programs to teach, remediate, and enrich academic content for students. Alignment of curriculum involves the comparison of local and state educational goals to the daily instruction, activities, and assessments in use in the classroom on a day-to-day basis. Tools for identification and prediction of student success may help educators plan, process, and implement programs to achieve academic goals. Tools for analysis could support self-reflection and evaluation of actions and

programs currently utilized.

Statement of the Problem

Educators lack an efficient, early method for predicting student success at the high school level in the public school setting. A method for prediction could provide data to support plans for meeting AYP and to guide appropriate programming to meet identified student needs. "To allow high schools to succeed in the massive effort [to improve academic achievement], middle schools must play their part in identifying potential dropouts . . . " before transition to the high school campus (Eye on Curriculum, 2008b, p. 1).

Identification of student success during the high school years relies on assessment tools administered to all students within the district. The Missouri Assessment Program (MAP) is the accepted tool for measuring AYP in the state of Missouri (Missouri Department of Elementary and Secondary Education [MO DESE], 2007). The assessment is administered to grades 3 through 11 in the areas of Communication Arts, Mathematics, and Science. The test was developed using a set of accepted standards, referred to as Grade-Level Expectations, in each of the three categories (MO DESE, 2007). Each year, districts throughout the state of Missouri administer the MAP and use the generated data to assess progress toward AYP.

The MAP is a customized, standards-based test " . . . built to measure the degree to which students have mastered a state's content standards . . . " (Popham, 2008, p. 128). Though some states use norm-referenced tests which compare a student's achievement with that of his or her peers, Missouri's assessment is criterion-referenced which compares student achievement to a list of expected goals or outcomes (DOE, 2008b).

Districts that have achieved curriculum alignment to the state standards and K–12 vertical alignment of academic content should yield a positive relationship between middle school MAP scores and subsequent high school Grade Point Average (GPA). The Missouri Department of Elementary and Secondary Education stated, "Educators and policy makers may appropriately use MAP results for groups of students to judge the effectiveness of educational programs and services offered at the local level" (MO DESE, 2008c, p. 2).

Valuable prediction tools allow districts to estimate the number of students likely to achieve an unsuccessful GPA, indicating a need for academic support. This allows a more accurate estimate of staffing requirements. Early preparation can (a) ease student transition into high school; (b) allow more accurate budgeting; and (c) support continued planning for the sophomore, junior, and senior years of high school. Assessment tools may offer appropriate data to provide the enrollment estimates needed by a district to support appropriate program planning.

The high school cumulative GPA seems to be used as an indicator for academic success. Students may apply for membership in National Honor Society if they meet a number of criteria, including a minimum cumulative 3.0 GPA (National Honor Society, 2008). Students achieving a cumulative GPA of 3.0 and above are eligible to enroll in dual credit programs that allow earning college credit and high school credit simultaneously for completion of a single course (Mehlville School District [MSD], 2008, p. 9; Saint Louis University [SLU], 2008). Some public and private post-secondary institutions in the state of Missouri base admission decisions upon several criteria, which include class rank calculated using cumulative GPA (Missouri University of Science and Technology [MUST], 2008; University of Missouri [MU], 2008; Webster University

[WU], 2008). Academic scholarship decisions include a consideration of cumulative GPA. Criterion level varies with each scholarship offer from 3.0 through 4.0 (MU, 2008; MUST, 2008; SLU, 2008; WU, 2008).

This study defined levels of high school success using categories of cumulative GPA. Categories examined were 2.0 & above; 2.5 & above; 3.0 & above; 3.5 & above; and 3.75 & above. The widely accepted, un-weighted GPA scale assigns an equal weight to the grade earned in each class attempted by a student. The scale assigns a value of 2.0 to a letter grade of *C*; a value of 3.0 to a letter grade of *B*; and a value of 4.0 to a letter grade of *A* (MSD, 2008; MU, 2008). These values are added and the sum is divided by the number of course credits attempted by the student.

At the time of this writing, the study site is implementing a district-wide, weighted GPA effective for dual credit and advanced placement courses offered during the 2008-2009 school year. Using the weighted scale, the assigned grade point value is multiplied by 1.5 for an honors course, 1.75 for a course offered for dual college credit, and 2.0 for an Advanced Placement course. This study examined freshman-year cumulative GPA. Freshmen do not enroll in courses offering the weighted grade point (MSD, 2008, pp. 14-21).

Establishment of a positive relationship between high school GPA and middle school MAP scores provides an indication that students achieving higher levels of cumulative GPA are more likely to master required core area academic content. Establishment of middle school MAP scores as reliable predictors of high school GPA could allow earlier data-driven decisions concerning academic programming. Following low achievement on the state merit exam, the Michigan State Board of Education decided

" . . . to take a closer look at whether school districts are identifying struggling students early enough and linking them with tutoring resources . . . " to provide maximum support for academic growth ("Test Scores", 2008, ¶ 2).

Several administrative decisions are impacted by reliable predictors of academic success in the high school setting. A prediction of lower success can allow plans for added support for the students indicated. Transition from middle school to high school is an area of concern (Smith, 2007). Early identification of students likely to have adjustment issues allows time for placement of a mentoring program or a ninth grade academy to provide proper support (Hertzog, 2006). One study gathered self-reported student suggestions for improving the move from the middle school setting to the high school campus (Cushman, 2006). Middle school students said, "Connect us up regularly with high school students" (Cushman, p. 49). Another suggestion was, "Match us up with student mentors" (Cushman, p. 51).

Prediction of high levels of academic success allows administrative decision-making to move its focus from additional academic support to provision for character education programs. Programs providing opportunity for service learning promote academic, and overall, student success. Etzioni (2008) stated that "Schools are under considerable pressure from the community to focus on academics. . . . Schools are, and ought to be, concerned with human and social development; ensuring graduates are able to work out differences with others verbally and nonabusively" (Conformist curricula section, ¶ 1). A feeling of self-worth and the practice of self-discipline is linked with academic success.

A predictive link between middle school MAP scores and high school cumulative

GPA also provides support for self-reflection and evaluation of district processes and programs currently in place. Data analysis provides support for the effectiveness of the district's formative assessment process (Popham, 2008). Establishment of a predictive pattern could provide a tool to strengthen evaluation of K-12 vertical and academic alignment of district curriculum, including alignment with state standards.

Purpose of the Study

This study analyzed the relationship between students' middle school MAP scores in Communication Arts and Mathematics and subsequent high school cumulative GPA following the freshman year of high school. MAP scores should provide an indication of a student's tendency toward appropriate content knowledge and relative study skill strength in core academic areas. Since all students in the district participate in MAP, scores should provide a prediction of a student's relative success in the high school setting, as measured by GPA during the freshman year.

Questions

The following questions were addressed in the study:

1. What is the relationship between middle school Missouri Assessment Program (MAP) scores in Communication Arts and freshman-year cumulative Grade Point Average (GPA)?
2. What is the relationship between middle school Missouri Assessment Program (MAP) scores in Mathematics and freshman-year cumulative Grade Point Average (GPA)?
3. What is the relationship between middle school Missouri Assessment Program (MAP) scores combined from the Communication Arts and Mathematics

categories and freshman-year cumulative Grade Point Average (GPA)?

4. What is the value of middle school Missouri Assessment Program (MAP) scores in predicting subsequent academic performance during the first year of high school?

Independent Variables

Communication Arts MAP scores. The relationship between Communication Arts Missouri Assessment Program (MAP) scores collected during eighth grade and freshman-year Grade Point Average (GPA) was analyzed.

Mathematics MAP scores. The relationship between Mathematics Missouri Assessment Program (MAP) scores collected during eighth grade and freshman-year Grade Point Average (GPA) was analyzed.

Combined Communication Arts and Mathematics MAP scores. The sum of scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) was an independent variable in this study. Scores earned during the eighth grade year were used.

Dependent Variable

High School Grade Point Average. The dependent variable in the study was the cumulative Grade Point Average (GPA) measured at the end of the freshman year of high school. The study considered the relationship between each of the independent variables and the dependent variable.

Hypotheses

Null hypothesis # 1. There is no significant correlation between eighth-grade Missouri Assessment Program (MAP) scores in Communication Arts and student success

during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Null hypothesis # 2. There is no significant correlation between eighth-grade Missouri Assessment Program (MAP) scores in Mathematics and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Null hypothesis # 3. There is no significant correlation between the sum of eighth grade scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Alternative hypothesis # 1. A positive correlation exists between eighth-grade Missouri Assessment Program (MAP) scores in Communication Arts and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Alternative hypothesis # 2. A positive correlation exists between eighth-grade Missouri Assessment Program (MAP) scores in Mathematics and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Alternative hypothesis # 3. A positive correlation exists between the sum of eighth grade scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Rationale for the Study

A means of predicting high school success may effectively promote a higher level of achievement for different types of students. Motivations to promote student success in the high school academic setting include each of the following:

- The need to support district efforts to raise the percentage of students who persist to graduation in a timely manner.
- The need to provide support for students who show signs of academic risk.
- The need to provide proper challenges for average and gifted students.
- The need to move the student population as close as possible to meeting AYP, as defined by NCLB.
- Provision of data to promote early programming and staffing of appropriate academics before the students arrive on the high school campus.
- Provision of data to validate and reinforce the district's successful K–12 vertical alignment of curriculum, as well as successful alignment of curriculum with state standards.

To improve student progress toward meeting AYP, many districts have decided to focus on the achievement of individual students to promote an improvement in tested subgroups of very small size. Sometimes one student moving to the next proficiency category represents a large percentage gain toward meeting AYP for that particular subgroup (Harman, 2008; Spurgeon, 2008). It would be helpful to identify academically-at-risk students early to provide proper academic support well before assessment is performed. Failure rates on Michigan's Merit exam created " . . . concerns about whether

struggling students are being spotted early enough . . . " (Eye on Curriculum, 2008b, p. 1).

Some markers used to predict student success at the high school level do not apply to every student. A study, such as this one, needs to analyze assessments that measure attributes and abilities for all students in the population. Some districts use additional assessments such as regular reading inventory exams completed by all students (Tell, Endsley, Frerichs, Kolodziejczyk, McDonald, Miller-Jones, & et al., 2003). An assessment applied to all students increases the possibility of identifying those academically at risk. This type of data could also provide a potential marker for identifying students who require more challenging coursework.

At the time of this writing, the study site is struggling to help individual, small subgroups meet AYP, as defined by NCLB. The district is one of many to closely examine the success rate of individual children to help strengthen the percentage of students indicating adequate progress in each of the small subgroups (Harman, 2008; Spurgeon, 2008). Student performance is examined at the end of each six-week session using individual course grades assigned on the report card. Students with failing grades are assigned to tutoring sessions offered during a school-wide academic networking period.

Historically, the district has identified students with low cumulative GPA and identified those academically at risk through teacher recommendation. Academic and behavioral characteristics within these student groups were identified. Students were placed in small groups during the academic networking period to allow an educational emphasis on appropriate study skills (Wisdom, 2006).

Currently, the district has identified students with low cumulative GPA and low grades in specific core-area courses. The students have, once again, been placed in small groups to allow an emphasis on appropriate study skills. It is helpful to identify students early, before entrance into high school, in order to provide proper support well before assessment is performed (Eye on Curriculum, 2008b). Middle school MAP scores provide a potential tool that has been administered to all students before the advent of high school enrollment.

Generalizations

Results of this study should be applied to schools and districts with demographics similar to the study site, a large suburban high school. The school district is located in St. Louis County, suburban to St. Louis, Missouri. Two high schools with enrollment of approximately 2100 students each, in grades 9 through 12, serve four middle schools and ten elementary schools (MO DESE, 2008b).

Limitations of the Study

Maturation. This study was limited by the effects of maturation of the population and subsequent random groupings. A comparison of data from middle grades to data at the end of high school involves a time span of six years. To minimize the extent of the effects of maturation this study used data from MAP administration during the spring of the eighth grade year compared to student GPA at the end of the freshman year. The effective time spans one year.

Instructional delivery. Students have multiple settings and multiple instructors delivering curriculum and evaluating individual daily assignments. To minimize this effect, all subjects were students enrolled in one single building within one school

district. All secondary students in the district high schools operate under the same district-wide curriculum, percentage grading scale, and calculation of cumulative GPA (MSD, 2008, p. 5). The middle school MAP scores represent historical data gathered prior to the proposal of this study. Differences in instructional delivery prior to assessment cannot be addressed. The number of different high school courses and instructors accessed by the sample used for the study was reported.

To provide a consistent and complete data set for the study, students who did not attend middle school in the district serving the study site were removed. These students are not a product of the same middle school curriculum and core teacher set as those who did attend in the district.

Testing environment. All subjects took the same MAP exams during the district testing window. The tests were administered by multiple proctors in multiple settings. Proctors received instructions for administering the exams, so difference in test administration was minimal. Individual differences in environment were not controlled. Outside traffic noise, hallway noise, and classroom climate can vary from place to place. Efforts were made to isolate rooms where students were testing from those conducting normal school activities.

Incomplete data sets. Students who did not participate in both Communication Arts and Mathematics assessment in middle school were removed. The data analysis indicated if one of these scores is a better predictor of cumulative GPA than the other. An incomplete data set does not allow this analysis.

Factors beyond the scope of this study. Students with learning disability or special needs received an alternate assessment. Scores from the alternate assessment were not

recorded in the file accessed by the researcher to gather MAP Communication Arts and MAP Mathematics scores. These students appeared to have an incomplete data set for purposes of the study and were removed.

A list of non-English speaking students was obtained. Information for these students was removed from the data analyzed. These students introduce factors beyond the scope of this study.

Grade Point Average (GPA) used as a success measure. Though GPA is calculated using the same method for all students in the district, each individual student's course selection throughout the four years of high school may differ (MSD, 2008, p. 12). All student four-year plans for high school offer opportunity for elective course selection. Each student was required the same number of course credits for graduation, but the choice of elective courses within the four year plan may differ from student to student (pp. 2-3). To calculate GPA, students receive " . . . marks [that] are based upon achievement and effort, as indicated by professional judgement" (p. 5). To address this potential limitation, the study examined a comparison of middle school MAP scores to freshman-level GPA. Freshmen have very little free elective choice in course selection for the year. The same core courses were required of all freshmen in the district (p. 12). Differentiated instruction was provided through offering three levels of rigor for coursework: concepts, regular, and honors.

Definition of Terms

Academically At-Risk. A student is identified as *academically at-risk* if progress toward

> earning course credit is not taking place in a manner timely enough to allow all requirements to be met for graduation by the end of the fourth year of enrollment

(MSD, 2008).

American College Test (ACT). An assessment provided by the American College Testing Program (ACT), Inc. used to indicate likely success on freshman-level college coursework (ACT, Inc., 2007a).

Adequate Yearly Progress (AYP). A criterion defined to measure a school district's success in promoting and maintaining progress in student achievement. Adequate yearly progress is the " . . . state's measure of progress toward the goal of 100 percent of students achieving to state academic standards in at least reading/language arts and math. It sets the minimum level of proficiency . . . " to be achieved on annual (DOE, 2008b, Adequate yearly progress section, ¶ 1). Each category of Missouri Assessment Program (MAP) assessment has an expected percentage of students in each defined student subgroup required to achieve proficient and advanced ratings for AYP to be met (DOE, 2008b).

Cumulative Grade Point Average (GPA). A numerical scale indicating the average of a student's assigned grades in all coursework attempted throughout the four years of high school enrollment ("Academic", 2008). In the district chosen for the study, the cumulative GPA did not include weighting of grades for honors or accelerated courses for freshman- level students (MSD, 2008, pp. 14-21). A grade of *A* receives a value of 4.0; a grade of *B* receives a value of 3.0; a grade of *C* receives a value of 2.0; and a grade of *D* receives a value of 1.0. Each year-long course is worth one credit. To calculate cumulative GPA, the sum of assigned values is divided by the total number of credits attempted. GPA ranges from 0.0 to 4.0 (MSD, 2008; MU, 2008).

Missouri Assessment Program (MAP). The MAP provides a state-developed assessment tool used in the public school setting for measuring student progress toward state-developed academic goals. Mathematics assessment is administered in grades 3-8 and 10. Communication Arts is administered in grades 3-8 and 11. Science is administered in grades 5, 8, and 11 (MO DESE, 2007).

No Child Left Behind Act (NCLB). Legislation originating in 2001 requiring individual states to provide a framework for school districts to measure success in promoting and maintaining progress in student achievement. A state assessment, plus criteria to be reached for considered success, is internally defined for each individual state (DOE, 2008a).

Student success. This study measured student success using the cumulative GPA earned at the end of the freshman year of high school attendance. A student achieving a 2.0 or above GPA is considered *average* or above and has met grading criteria for earning credits toward graduation. To further define differentiated levels of success, five categories of GPA were considered in the analysis. Categories discussed were 2.0 & above; 2.5 & above; 3.0 & above; 3.5 & above; and 3.75 & above.

Summary

This study investigated the relationship between middle school Missouri Assessment Program (MAP) scores and freshman-year, high school cumulative Grade Point Average (GPA) and the usefulness of MAP scores in providing information to guide academic programming to meet study body needs. Many characteristics, attributes, and measurements are used to help develop instructional programs to provide an optimal

educational setting for public school students, including reading inventories, American College Test (ACT) scores, cumulative GPA, and monthly benchmark test scores (Tell et al., 2003). A number of private institutions admit students considered academically successful and refuse admission to those considered otherwise (Matthews, 2008a, p. B01).

Public schools must educate all. All Missouri public schools participate in the MAP, which tests student academic progress toward a set of academic standards referred to as Grade Level Expectations (MO DESE, 2006). Since all students enrolled in participating districts complete the assessment, scores are available for all students in the areas of Communication Arts and Mathematics. To provide for proper placement within programs offered and to design appropriate program and course offerings requires knowledge of the incoming population of students.

As well as planning proper support for students who struggle academically, predicting high school GPA could perhaps help to effectively promote a higher level of achievement for different types of students. Early identification of student strengths could provide for planning proper challenges for average and gifted students, such as the availability of Advanced Placement or International Baccalaureate programs.

In attempting to meet the requirements of AYP as mandated through NCLB, many districts seem to place an emphasis on state assessments. There are educators who are definitely in support of the use of data generated by state assessments for guiding student achievement. There are also educators who strongly oppose the seemingly large emphasis on pushing students to score higher on assessments, rather than placing an emphasis on specific learning goals generated with the child's best interest at the center

of decision-making. The review of literature in the next chapter addresses opposing viewpoints. A discussion of views, as well as a discussion of educational strategies that have been developed and implemented, is included.

CHAPTER TWO – REVIEW OF LITERATURE

This study searches for predictors of student success on the high school level through analysis of the correlation between scores on state assessments administered during the middle school years and grade point average calculated at the end of the first year of high school. Review of literature did not yield information on this relationship. A search of literature concerning grade point average revealed viewpoints on the type of scale to be utilized. Review of literature concerning state assessments administered during the middle years provided information on best practice routines within the classroom and discussion on the usefulness of benchmark testing. Most literature concerning student success focused on the transition from high school to college-level coursework.

This review offers a summary of opposing viewpoints on high-stakes testing. Best practices and techniques for incorporating gathered data into decision making are summarized. Research similar to this study focused on prediction of success on college-level coursework. A summary of studies linking high school grade point average and scores on the American College Test (ACT) to college-level grade point average is presented.

Preparation for Post-Secondary Study

One goal of high school education systems today is to prepare students for post-

secondary study. Many students attend courses offered in a traditional four-year college or university setting following high school (Missouri Department of Elementary and Secondary Education [MO DESE], 2006). Attention has been given by high schools and colleges to predicting student success in the completion of college-level coursework (Matthews, 2008b; "The Top", 2008). A number of colleges use scores on the ACT as one factor in the admission decision for applicants (American College Testing Program, Inc. [ACT, Inc.], 2007a). The link between ACT scores and freshman-year success on college-level coursework has caused some schools to offer preparation courses with the intention of maximizing student success on the exam (Pike & Saupe, 2002).

The American College Testing Program, Inc. (ACT, Inc.) has developed the EXPLORE program and the PLAN program to promote improved student achievement on the ACT. The EXPLORE program, administered in eighth or ninth grade, was designed to identify student academic strength and weakness and to prepare students for high school work and post-high school choices (ACT, Inc., 2007b). ACT, Inc. stated that the PLAN program, administered in 10th grade, " . . . provides information needed to address school districts' high-priority issues" (ACT, Inc., 2007c, ¶ 1). It was designed to help measure current academic development and plan for remaining high school years. The inventory provided a comprehensive guidance resource to help measure current academic development, explore career and training options, and make plans for the remaining high school and post-graduation years. The PLAN was intended to be used as a predictor of success on the ACT and was referred to as a pre-ACT test (ACT, Inc., 2007c).

Motivation for Study

Because of education's recent concern for reaching required success rates on state-administered assessment tools in line with the No Child Left Behind Act (NCLB), districts are more concerned now than in the past with identifying student abilities at the high school level. The Missouri Assessment Program (MAP) is based on state-developed standards referred to as Grade Level Expectations (MO DESE, 2007). Districts that align curriculum with state standards and coordinate course content to allow Kindergarten through 12th grade (K-12) vertical curriculum alignment should yield a strong, positive relationship between middle school MAP scores and subsequent high school Grade Point Average (GPA). The Missouri Department of Elementary and Secondary Education stated, "Educators and policy makers may appropriately use MAP results for groups of students to judge the effectiveness of educational programs and services offered at the local level" (MO DESE, 2008c, p. 2).

The fact that ACT, Inc. has been able to develop a tool identified as useful for predicting post-secondary success (Noble & Sawyer, 2002) indicates that educators should be able to identify similar tools to be used as predictors for high school success. Most of our nation's high schools use cumulative GPA as a comparison measure ("Academic", 2008) and, since the advent of NCLB, administer yearly state assessments (United States Department of Education [DOE], 2008a). The relationship between middle school state assessments and high school success should be explored.

The implementation of NCLB in 2002 has generated a more self-reflective consideration of the strategies used to educate our children in the public school setting. As districts struggle to meet state-developed requirements for AYP, educators find

themselves requiring reliable measuring tools and a method for closely predicting the likelihood of academic success for individual students. Successful academic prediction tools have been developed by companies such as ACT, Inc. and have been used to predict academic success in the college setting. This study was designed to explore the predictive nature of state assessment scores as related to high school GPA.

Theory

Review of literature related to student success revealed historical and philosophical discussion concerning state-mandated assessment and use of data gathered from its administration. The adaptation to meeting demands for increased student achievement on mandated assessments has generated detailed observation of test preparation, curriculum alignment, preparation strategies, and improved classroom instructional practices. A summary of resulting instructional theory is presented in this review. This study attempted to identify middle school assessment scores as an effective predictor of student success on the high school level. A discussion of high-stakes testing and classroom best practices provided related information.

In 2002, President George W. Bush signed legislation to launch the No Child Left Behind Act (NCLB), which established the objective that "Every child in every school must be performing at grade level in the basic subjects that are key to all learning, reading and math" (Williams, 2005, p. 156). Committees in each state quickly began a process to define performance at grade level and to develop a process by which to measure this performance. From that time, educators have been debating the wisdom of implementing NCLB and the effects that formalized assessment, which would henceforth be referred to as high-stakes testing, would provide for our students (Williams, 2005).

Recognized names in the field of education were found expressing viewpoints in support of or in opposition to the use of high-stakes testing. There are educators who oppose the use of formalized testing for evaluation of the educational process within a school district. Opposition is focused on perceived negative effects for students. Supporting viewpoints include descriptions from educators who have devised ways to utilize the data provided by required assessments to develop new strategies for learning. Some have redefined educational terminology. The result is a collection of best practice strategies now available for educators at all grade levels.

Consideration has also been given through review of literature to topics related to maximizing MAP scores and enhancing student GPA, such as types of assessment, curricular alignment, differentiated instruction, state standards, and processes to maximize the value of administering assessments.

Strategies Resulting from Opposition to High-Stakes Testing

Miltich (2005) wrote that assessment should take a definite back seat to the process in which dedicated teachers encourage their students to appreciate learning. He stated his belief that " . . . learning is a deeply personal and enriching experience that ultimately cannot be measured through standardized evaluation . . . " (p. 151). He expresses the sentiment of a number of prominent educators. Those with a passion for the art of teaching sometimes feel that formalized assessment reduces the educational experience to one that includes less emotion for the subject for both the teacher and the student.

Jones (2004) also expressed that an alternative to the use of high-stakes testing is needed. A system based on the needs of the learners and high expectations would be

more effective. He felt that the present use of high-stakes testing has " . . . flawed assumptions, oversimplified understandings of school realities, undemocratic concentration of power, [leading to an] undermining of the teaching profession, and predictably disastrous consequences for our most vulnerable students" (p. 1). Some researchers, such as Amrein and Berliner, have analyzed student characteristics that they feel are related to the consequences referred to by Jones.

Amrein and Berliner (2003) proposed that research supports negative consequences, such as high drop-out rates and decreased student motivation, resulting from high-stakes testing. Schools often emphasize drill activities and use district funds for test preparation materials. Materials such as these are not always effective and can undermine the validity of standardized testing.

Perkins-Gough (2005) supported multiple measuring tools rather than high-stakes tests. She stated, "State laws that require students to pass an exit examination to receive a high school diploma can harm students and schools" (p. 90). She also reported that some states requiring a high school exit exam have an alternative assessment for those who do not pass the exam. She reports that some educators utilize assessments that consist of portfolios, performance assessments, and grades in classes that have a connection to the state standards. Statements by this author are a reminder that observations of the learning process do not have to occur only through formalized, paper-pencil types of assessment. Educators can observe a number of student characteristics to formalize and guide the learning goals for the classroom.

Perkins-Gough (2005) expressed her feelings that the NCLB requirements have reduced innovation in state testing programs. She suggested that districts use multiple

tools to measure student success. She stated that research shows that multiple assessments include the following characteristics:

- Encourage teaching and evaluation of the use of a wider range of thinking and performance skills.
- Recognize different ways for demonstration of learning, and reduce the likelihood of inappropriate student placement.
- Increase the defensibility of graduation decisions.
- Provide diagnostic information for improvement of instruction.
- Reward student attendance and successful course completion.
- Encourage student engagement and persistence to graduation. (Perkins-Gough, 2005, p. 91)

Perkins-Gough suggests a number of viable strategies to be used in place of formalized, state-designed assessment. The diversity of her list strengthens her feelings that educators can be innovative in designing methods to observe, evaluate, and guide the educational process.

Schmoker (2003) cautioned teachers to keep both data gathering and data analysis simple. He stated that data can help us guide improvement in teaching and learning. Educators should have a few, simple goals to promote focused attention from everyone involved. A team of educators should decide on the most effective focus that will yield the strongest improvement results. Both strengths and weaknesses should be identified and acted upon.

Schmoker (2003) felt that over-analysis of a situation adds to already-overloaded teacher resources. He suggested a simple template for a focused improvement plan that

included annual goals to provide for improved teacher attention on student improvement. He encouraged that we should not let our desire to use data analysis get in the way of making effective choices for student achievement improvement.

Herman and Baker (2005) also suggested strategies for improving assessment success. Six criteria are suggested to help teachers assess student skills as they design their own teacher-made classroom assessments. Suggested criteria include the following:

1. Align standards and benchmark assessments in the early-planning stage.
2. Plan for the diagnostic value of assessment results through initial item and test structure design.
3. Assure that benchmark assessments are fair for all students, including English language learners and students with disabilities.
4. Insist on data showing tests' technical qualities.
5. Build in utility.
6. Hold benchmark testing accountable for meeting its purposes.

Herman and Baker (2005) suggested strategies that are similar to formalized state assessment, such as the use of alignment between state standards and the benchmark goals used in the classroom. However, unlike state assessments, they are suggested that the assessment process be streamlined and embedded into everyday classroom experience. They insisted that benchmark testing meet the required purpose; otherwise the activity will use valuable student learning time without pushing student achievement in the positive direction.

Strategies Resulting from Support of High-Stakes Testing

In a position paper supporting standardized testing Hooper (2005) stated that

students who study in a setting that provides preparation for and administration of standardized testing "will have a significant opportunity for success – because the system wins every time" (p. 147). He felt that educators should not debate about high-stakes testing. Debate should focus on the responsibility of educational systems to build a process that will provide maximum success for learning.

Guskey (2003) strongly supported the concept that classroom assessments can provide immediate teacher feedback for guiding instruction. He explained that classroom assessments can take a variety of forms, such as (a) verbal questioning, (b) student portfolio, or (c) performance laboratory activity. He let the reader know that the content of a teacher-made classroom test does not have to be a secret from the students. Placing clear expectations for the students is not the same as teaching the test. Guskey also de-stressed the heavy use of statistical analysis. A simple count of the number of students with correct answers versus incorrect answers on each item of an assessment can guide the teacher's next step in instructional planning for the classroom. Guskey suggests that educators keep their evaluation processes simple.

A more technical view of data usage was addressed by Popham (2003). He presented a view that data from student assessments is a good entity to gather and very worthwhile to use for constructive improvement of instruction and of student achievement. He gave sound advice concerning which types of data are best to use, as well as which types one should avoid.

Popham (2003) stated that the wrong kind of data can " . . . stifle teachers' pursuit of accurate evidence . . . " (p. 48) when considering the correct instructional pathway to choose. He described test data as being most important because it is being used to

evaluate teacher effectiveness. He said that data from the state assessment usually yields no useful data for instructional guidance. Popham (2003) also described five attributes of instructionally useful data:

- Significance. An instructionally useful test measures student progress in meeting curricular goals.
- Teachability. An instructionally useful test should measure something teachable. Teachability means that most teachers, if they deliver reasonably effective instruction aimed at the test's assessment targets, can get most of their students to master what the test measures.
- Describability. A useful test provides a sufficiently clear description of the skills and knowledge it measures so that teachers can design properly focused instructional activities. These descriptions must be provided in plain language.
- Reportability. An instructionally useful test yields results at a specific enough level to inform teachers about the effectiveness of the instruction they provide.
- Non-intrusiveness. In clear recognition that testing time takes away from teaching time, an instructionally useful test shouldn't take too long to administer—it should not intrude excessively on instructional activities.

Popham (2003) also discussed nationally standardized achievement tests. He stated that these tests are not instructionally useful. The standardized tests lack the following discussed attributes: describability, teachability, and reportability. Standards-based tests do not do a good job of describing to the teacher exactly what the student was missing in terms of preparation. The author stated that they do not measure what they pretend to measure (p. 50).

McTighe and O'Connor (2005) also redefined terminology when referring to assessment. The authors suggested assessment and grading strategies to enhance the use of data through immediate feedback for students. Three categories for classroom assessment were defined as (a) summative, (b) diagnostic, and (c) formative (pp. 11-12).

Summative assessment takes place at the end of a unit and is not a good tool for guiding instruction throughout the unit. Diagnostic and formative assessments provide feedback to be used along the way. Standards and benchmarks are not to be used as a list of things to accomplish. The language used in describing these should include the desired performance outcomes, assuring that they are authentic (McTighe & O'Connor, 2005, pp. 11-12). The authors described the difference between formative and summative assessment and suggest that educators benefit from the use of both.

McTighe and O'Connor (2005) suggested sharing summative expectations at the beginning of the unit, as does Schmoker (2003). A clearly stated rubric can be a useful tool in guiding students' learning. Teachers need to account for student differences in designing assessments. Students process learning in different ways. However, they also differ in their strengths for demonstrating knowledge (McTighe & O'Connor, 2005). Sharing the rubric for an evaluation in advance should clearly demonstrate to the student the learning goals in the form of viewing the outcome. This process could guide the learning activity from beginning to end.

Performance options must fit the standard they will demonstrate. The type of performance option should be worth the time for the teacher, student, and class. Feedback must meet four criteria. It must be timely, specific, understandable, and allow for self-adjustment on the student's part (McTighe & O'Connor, 2005, pp. 15-16). The learner

needs the opportunity to refine, revise, practice, and retry (p. 17). McTighe and O'Connor have turned the use of testing data into an effective teaching process.

The educational process of adjusting to the demands of NCLB through AYP requirements has resulted in an analysis by a number of educators who have produced several *best practices* for the classroom practitioner. The use of both formative and summative assessments, along with the development of a grading rubric for activities, strengthens the classroom experience for the student. Encouragement for the educator to use a variety of evaluation tools, such as portfolio activities, verbal checks, and hands-on performance events, allows for further differentiation of both instruction and evaluation. It is likely that this process produces an environment conducive to learning for all children.

Strategies and Best Practice

Leahy, Lyon, Thompson, and William (2005) defined assessment *for* learning and explained its value to the classroom teacher. Assessment *for* learning, as opposed to assessment *of* learning, includes five nonnegotiable strategies for assessment. They are: (a) clarifying and sharing learning intentions and criteria for success; (b) engineering effective classroom discussions, questions, and learning tasks; (c) providing feedback that moves learners forward; (d) activating students as owners of their own learning; and (e) activating students as instructional resources for one another (pp. 19-24). Leahy et al. help the educator understand that assessment can have different purposes, as well as take different forms.

Details for implementing the strategies were discussed at length. The assessment strategy described includes a global process for teaching that places responsibility on the

student. The discussion by Leahy et al. (2005) also formed a rebuttal to Nichols and Berliner (2008) who insisted that high-stakes testing develops reluctant learners by removing self-motivation. Self-motivation becomes a part of the process when the student owns his or her own learning (Leahy et al., p. 23).

Chappuis (2005) also supported students' accountability for their own learning processes. She outlined seven strategies to be used to strengthen student skills in formative assessment activities. The focus is on student skills in self-assessment and necessary activities that will yield academic improvement. The strategies help students to " . . . understand their learning goals, recognize their own skill level in relation to the goals and take responsibility for reaching the goals" (p. 40).

In summary, strategies and best practices that have developed in response to the nation's call for greater accountability in the field of education have strengthened the partnership between the educator and young student. Students have become more responsible and more accountable for their own learning outcomes. Educators have become more knowledgeable concerning strategies and assessment formats available for use, as well as more self-reflective concerning classroom practices.

Transformative Assessment

Popham (2008) used the phrase *transformative assessment* and described the history of our state testing systems as they have progressed to their current point. He defined and emphasized formative assessment as a process that enhances student achievements. He stated that the phrase "Formative assessment works!" (p. 1) is frequently voiced in many parts of the world.

Popham (2008) described formative assessment as " . . . a potentially

transformative instructional tool that, if clearly understood and adroitly employed, can benefit both educators and their students" (p. 3). He paraphrased a definition for formative assessment as " . . . a planned process in which teachers or students use assessment-based evidence to adjust what they're currently doing" (p. 6). Formative assessment is a process, not a test. Teachers and students make learning adjustments based on evidence of the students' current level of mastery with respect to certain, predetermined skills or bodies of knowledge. The main goal is to improve students' learning. One obvious way to reach this goal is to improve how the teacher is conveying knowledge. Formative assessment can help with this action (Popham, 2008). As the educator frequently checks for student understanding, there should be constant adjustment in the choice of classroom activity or the depth to which the classroom discussion proceeds. This constant adjustment in learning and teaching style strengthens the final student outcome as measured by student achievement.

Popham (2008) described standardized testing as insensitive to student needs, supporting those testing regulations that he categorized as sensitive. "An instructionally sensitive accountability test would be one that would include many items that uninstructed students would tend to answer incorrectly and instructed students would tend to answer correctly" (p. 125). He said that educators need to realize that "developers of traditional standardized achievement tests have no interest in building tests to measure instructional quality" (p. 125). The tests are designed to produce comparative score interpretations and only need a sufficient point spread to provide a comparative description.

Popham (2008) described customized, standards-based testing used by many

states and expressed his view that this type of testing is more valuable to the educator. Teachers sometimes talk of too much curriculum to fit the existing time frame for teaching. Popham said that our schools frequently have too many learning targets (p. 128). More recent learning goals are very content specific. Preparation for content based exams is sometimes difficult; however, Popham supports the value of this type of testing as being worth the extra effort on the part of the educator.

Scherer (2005) positively supported the use of collaborative, formative assessment to guide instruction for the purpose of increasing student achievement, as defined by the state assessment score. She quoted a number of researchers, such as McTighe, O'Connor, and Leahy, as lending support to her statements and described a number of practices that must be in place for success to be a part of any assessment program, such as (a) choice of learning outcomes, (b) frequent and varied assessment, and (c) active accountability on the part of the student (Scherer, p. 9).

Ubben, Hughes, and Norris (2007) acknowledged that the use of assessments yields a great deal of data for school district use. Data-driven decision making can be an effective tool in driving the direction a district takes with classroom instruction. The National Study of School Evaluation provided a four-step process for the use of data in decision making: (a) mining the data, (b) analyzing the data, (c) communicating the data, and (d) using the data. Gathering and maintaining the data is referred to as warehousing (p. 60). Ubben et al. supported the use of data in making relevant student-centered decisions and described techniques used to manage the large quantities of assessment data available to the educator.

Transformative assessment is an area of teaching and learning that allows a focus

on both the learning process and the assessments now required in our educational system. The educator should use a variety of informal and formal assessment techniques to guide student learning. Formative assessment has the potential to strengthen student learning and transform the educational process into one that prepares the student for the more formal state-designed assessments associated with AYP.

Alignment of Curriculum

A strategy recently emphasized by districts struggling to improve student achievement on state assessments is alignment of curriculum (Show-Me Curriculum Administrator's Association, 2008). Alignment has been discussed by various authors as it relates to horizontal alignment across district grade-level buildings, vertical alignment through examination of content exposed to students progressing from grade level to grade level, and alignment of curriculum content to state standards.

Glatthorn (2004) referred to the different types of curriculum in existence within one school district and defined alignment in the following statement.

> Curriculum alignment can be defined as a process of aligning the written curriculum (the one that appears in guides), the tested curriculum (the one that appears in the tests), and the supported curriculum (the one that appears in textbooks and other resources) to make the taught curriculum (the one the teacher actually delivers) more effective (p. 49).

Wong and Nicotera (2007) equated curriculum alignment with improvement in instruction with the statement that " . . . using academic content standards to guide the selection of curriculum may remove a great deal of the uncertainty and inconsistency that takes place in schools on a regular basis" (p. 91). Alignment of standards with both

instruction and assessment is also supported. The educator should consider required standards when planning lessons and choosing student activities. The standards should also be considered when choosing the type of assessment and creating the grading rubric to be used. If a team of educators works on this alignment together, students across the district could receive more uniform instruction and assessment. This uniformity could strengthen the learning outcome district-wide, as well as bring the student population closer to meeting AYP at the end of the school year.

Carter (2007) supported the use of assessment in the classroom and agreed with Wong and Nicotera that its alignment with curriculum provides a valuable tool. Carter stated, "Aligned classroom assessment helps students and teachers focus their energy on the learning students must master so they can perform well on high-stakes assessments" (p. 102). She also stated that aligned instruction in the classroom " . . . requires teachers to be goal-oriented during both the planning and the executions of lessons. Teachers should begin instruction with clear learning goals in mind and use strategies and activities that are congruent to the established learning goals" (p. 70). Carter condoned complete alignment of the learning process. She discussed *total instructional alignment,* an instructional system that demanded that alignment be achieved among standards, curriculum, instruction, and assessment. Carter believed the instructional process can be designed to the smallest detail, ensuring student success.

Content Standards

State content standards currently play a major role in the development of school curriculum. The move toward state standards began in the early seventies to combat high operation costs for school districts combined with poor student achievement (Wiles &

Bondi, 2007, pp. 135-137). Missouri has a set of state content standards referred to as Grade Level Expectations that was originally developed following a look at standards endorsed by national academic content organizations, such as the National Council of Teachers of Mathematics. At the time of this writing, the state is revising science expectations, and continually reviews of all content areas.

Reeves (2006) advised that educational leaders help teachers save time by focusing on the academic content standards that are more important. He referred to a term, *power standards* (Reeves, p. 105), coined by Ainsworth (2003). The terminology was designed to help faculty understand that not all standards have equal importance when decisions are made about content delivery to students (Ainsworth, 2003). Focusing on the more important content standards allows educators to decide which content to retire (Reeves, 2006).

The need for an early warning system for low performing students is supported by Reeves (2006). He stated that leaders may be able to " . . . avoid the long-term consequences of failure that too frequently accompany students whose academic performance lags far behind that of their peers" (p. 114). Low scores on state assessments have emphasized the need for an early warning system for low performers. Failure rates on Michigan's Merit Exam caused " . . . concerns about whether struggling students are being spotted early enough . . . " (Eye on Curriculum, 2008b, p. 1).

Popham (2006) discussed the crucial link between educational accountability and state content standards. He explained a flaw in the accountability process hinged on the use of state standards in the construction of assessment tools. Popham claimed that some states have standards too numerous and poorly conceptualized for teaching and testing

(p. 88). He explained that a list of standards that is too long leads to assessments that cycle the topics tested each year. The cycling of topics creates a hit-and-miss situation in which the teacher must try to guess which topics to emphasize in preparation for student assessments. Also, when the assessment does not test every standard, the educator does not get a clear picture of which areas of instruction need improvement (p. 88). Popham provides educators with a specific flaw in the testing process, which they may address as they choose the best path to follow in preparing students for the assessments.

In some states, the content standards are a general list, with many subtopics, to be studied. Within the subtopics are benchmarks, or expectations, that will be more helpful to the educator in forming a plan for which content is to be learned by the students (Popham, 2006, p. 87). Popham called for an overhaul, or at least a close scrutiny, of state content standards so that they represent goals that truly can be taught within the time frame allowed. He expressed a strong belief that worthwhile standards can be developed, along with excellent accountability assessments (p. 88).

State content standards, when used carefully by the educator, can provide an excellent guide to subjects, topics, and activities to be covered in the classroom. The educator should consider that the state standards are living documents, likely to change from year-to-year to best meet the needs of the state student population. The educator needs to be vigilant, informed, and aware that the standards offer an excellent educational tool when used in a careful and instructional manner.

Differentiated Instruction

Brimijoin, Marquissee, and Tomlinson (2003) described a sixth grade classroom in which the teacher continually uses assessment data. The teacher's assessment tools

encompass a variety of methods, both formal and informal. She used (a) results from quizzes, tests, and daily assignments; (b) oral questioning; (c) journal prompts and webbing; (d) *what do you know?* activities; and (e) group discussions to generate meaningful data to be used to evaluate her students' most current progress.

Brimijoin et al. (2003) described a teacher who viewed her data collection as three-dimensional. The teacher used results to guide instruction and to assess its effectiveness. She used " . . . multiple methods of data collection and views the process as dynamic and continuous . . . " (p. 72). Data collection was used " . . . to determine students' prior understanding and achievement, to track their responses to moderate challenges, and to measure their outcomes against expected performance goals" (p. 72). The sixth grade teacher was able to operate a dynamic elementary classroom while continually assessing the educational status of her students. Students participated in numerous spontaneous self-assessments. Depending on the answers to a few simple, quick questions, students followed different paths of re-teaching, review, and reinforcement. The teacher was continually providing a complete set of differentiated instruction for the students in her class (Brimijoin et al., 2003). The pressures felt by the teacher to cover expected standards in a finite time frame were addressed in the article. The teacher felt that her use of data to guide instruction helped meet the task of improving student academic achievement (pp. 71-73).

Research

Review of literature yielded solid research concerning strategies to improve student achievement on state assessments, as well as concerning those strategies that do not yield positive results. Classroom observation of the consequences of high-stakes

testing has prompted strategies and the attempt to use data in a positive manner to move our children closer to meeting Adequate Yearly Progress (AYP), as defined by NCLB (DOE, 2008b). More recent literature provided research to support or refute the effectiveness of many of these strategies and attempts at data usage.

Research Providing Opposition to High Stakes Testing

Nichols and Berliner (2008) strongly opposed high-stakes testing and supported their view with solid research. Criticism of regular assessments claimed that "School cultures dominated by high-stakes tests are creating more and more reluctant learners" (p.14). Since the implementation of NCLB, each child in grades three through twelve takes tests in reading and math each year. Science will soon be an additional requirement (MO DESE, 2007). Many students also take regular benchmark tests to help predict performance on mandated tests (Wisdom, 2008).

Research has shown no evidence of increased test performance on assessments other than state-provided ones. There have been no reliable increases in scores on the National Assessment of Educational Progress (Nichols & Berliner, 2008, p. 14). Achievement gaps between students of higher and lower socioeconomic classes have not appreciably narrowed.

Nichols and Berliner (2008) felt that there are unintended, negative effects of high-stakes testing that are cause for concern. Their research has found that this type of testing has been associated with cheating and, in some cases, data manipulation (Nichols & Berliner, p. 14). Some educators are skeptical of assessment results, " . . . pointing in some cases to shorter exams, easier questions or a lowered bar for passage" (Eye on Curriculum, 2008a, p. 1).

Nichols and Berliner (2008) stated that mandated testing will "undermine teacher-student relationships, lead to a narrowing of the curriculum, demoralize teachers, and bore students" (p. 14). When teachers focus narrowly on one skill to be taught, students learn isolated bits of information without a connection to usefulness to make the learning meaningful. Nichols and Berliner also claimed that learners are "more likely to enjoy learning when activities are meaningful, fun, or interesting" (p. 14). Students are "more hardworking and persistent when they perceive the purpose of learning as self-improvement or achievement of personal goals" (p. 15). A 2006 survey of school dropouts indicated that an uninteresting or uninspiring school setting contributes to the decision to drop out of school (Nichols & Berliner, p. 15).

Perkins-Gough (2005) cited research indicating harmful effects of state laws requiring high school exit exams. There is evidence that high school exit exam policies can "reduce graduation rates, narrow the curriculum and lead schools to neglect higher-order thinking skills" (p. 90). Many states use a multiple choice format for testing. This type of question tends to minimize the emphasis on complex thinking, communication and problem solving. The author's discussion seems to lend strength to the idea of alternate types of assessment. High pressure testing affects the student, as well as the educator designing the learning activities.

Successful Assessment Scores Required for High School Diploma

The state of New York is among those administering high school exit exams beginning in 1878. Starting with the class of 2003, the state required students to pass five of its Regents Examinations. The high-stakes tests are end-of-course exams aligned with the state learning standards. The class of 2010 will have the added requirement that

students with disabilities will need to achieve the same scores as nondisabled students to pass the exams (Center on Education Policy [CEP], 2006).

> The Regents Examinations provide schools with a basis for evaluating the quality of instruction and learning. The exams are used by school personnel to identify major learning goals, and they offer teachers and students a guide to important skills and concepts. The Regents Examinations also provide students, parents, counselors, administrators, college admissions officers, and employers with objective and easily understood achievement information that can be used to make sound educational and vocational decisions. Passing scores on the Regents Examinations in English, mathematics, science, and social studies satisfy the state testing requirements for a high school diploma. (p. 170)

The state of New York is progressively moving the bar higher for students participating in state high-school-exit assessment.

Conflict, in the form of legislation, was first observed in California and Arizona during the 2005-2006 school year. Court cases appealing the decision to withhold high school diplomas based on scores achieved on high school exit exams were filed. The California decision to withhold diplomas was reversed by the superior court and then reinstated during appeal to the state Supreme Court (CEP, 2006, p. 20).

As opposition to the pressure placed on public school districts caused by state-mandated assessment increases and student accountability begins to weigh in with consequences such as the denial of a high school diploma, the courts can expect more frequent occurrence of litigation surrounding NCLB and AYP.

Research Providing Support for High-Stakes Testing

Fisher and Frey (2007) offered a common-sense rationale for the use of assessment. Among other activities discussed, data can be used for (a) diagnosing individual student needs, (b) informing instruction, (c) evaluating programs, and (d) providing accountability information. (p. 99). Diagnosis of individual student needs lends itself to differentiation of instruction, which should lead to higher student achievement. Program evaluation could help strengthen a district's confidence that its alignment of curriculum, both with state standards and within the vertical movement of students through the grade levels, is solid and working in a positive manner toward higher student achievement.

Related Study

Review of literature did not reveal studies comparing middle school state assessments to subsequent high school cumulative grade point average. However, several studies addressed similar comparisons. Most focused on assessment tools linked to subsequent college-level achievement.

Predictors of College Success

Some studies have compared successful first-semester college GPAs to entry-level ACT scores, noting that the scores were a good predictor of success. An early study setting the stage for exploration was provided by Pike and Saupe (2002) who asked, "Does High School Matter?" Analysis of three methods of predicting first-year college grades concluded that the ACT score is a good predictor for success.

Allen and Sconing (2005) also found the ACT assessment to be a reliable indicator for success in freshman college-level coursework. Their study established the

following benchmarks for readiness, as indicated by an appropriate subtest score on the ACT assessment: English Composition, English, 18; College Algebra, Mathematics, 22; Social Science, Reading, 21; and Biology, Science, 24. "The benchmark values represent predictive indicators of success for typical students at typical colleges" (p. 2).

Attention has been given to predicting student success in the college setting. This prediction can allow districts to better prepare students for post-secondary study. Also, it can allow a college to gear up to provide support for incoming freshmen, increasing successful persistence to graduation. American College Testing, Inc. has been successful in designing assessment and appropriate benchmark cutoffs to predict the likelihood of a successful college career for incoming freshmen.

High School GPA and ACT Scores as Success Indicators

Noble and Sawyer (2004) examined the relationship between GPA and admission scores on the ACT to determine if high school GPA is a better predictor of success than an ACT score. High school GPA was found to be a better predictor only in a limited number of categories, where the ACT score was a better predictor across the board. Results provided by Noble and Sawyer improved upon a much earlier, related study by Myers and Pyles (1992) who suggested that both ACT scores and high school GPA should be used in a combined effort to predict first-year, post-secondary success. Their study included a look at student diversity in both background and ethnic orientation. Though ACT, Inc. has developed a successful predictive assessment, there is no support to indicate that high school GPA will provide a strong relationship in predicting college success.

High School GPA and Standardized Assessment Scores

A study conducted by Kobrin, Milewski, Everson, and Zhou (2003) compared High School GPA to Scholastic Achievement Test (SAT) scores. The authors considered four factors: (a) economic advantage, (b) school size, (c) technology access, and (d) school resources to categorize results. The conclusion was that other factors, not included in the study, must be present to cause a noted discrepancy between high school GPA and SAT scores.

Literature review revealed one study that included an examination of the relationship between high school GPA and state high school assessments. Other factors were included in the comparison, as well. Saginaw Public Schools (1993) examined the relationship between high school GPA, the state assessment tool (Michigan Educational Assessment Program [MEAP]), and student absences for 10th grade students. A strong connection between the MEAP and high school GPA was not found.

Researchers have considered several factors that could indicate strength or weakness in preparation for academic study on the college campus. Factors considered include school size, student attendance rate, and high school GPA. High school GPA does not show a consistent relationship to college success and therefore should not be considered a strong predictor.

Use of 10th Grade PLAN to Improve ACT Scores

ACT, Inc. addressed student preparation for the ACT exam through a self-developed program named the Educational Planning and Assessment System (Williams & Noble, 2005). The system has three components intended to evaluate student weaknesses and strengths to allow formulation of a study plan in preparation for college

work. The EXPLORE assessment is taken in 8th or 9th grade, the PLAN assessment is taken in 10th grade, and the American College Test (ACT) used for college entrance evaluation is taken in 11th or 12th grade (Williams & Noble, 2005). Each component offered feedback for an approach toward academic improvement and strength.

Williams & Noble (2005) conducted a study to evaluate the effectiveness of administering the PLAN assessment to district 10th graders consistently within a district over a span of time. ACT scores were examined for students within districts consistently using PLAN during the years 2000 through 2003 and found that ACT scores did show a continued pattern of improvement. Improvement was indicated in higher ACT scores and more rigorous coursework selection during the remaining high school years.

Benchmark Standards and Subsequent Performance

A review of literature did not find studies linking middle school assessments to predictions of high school GPA. However, the review did find an exploration of the relationship between standardized testing and benchmarks for improving instruction. Historically, excellent instruction has always been a goal within educational settings. The advent of NCLB has prompted a closer look at the actual scores achieved on state assessments.

Support of benchmark testing was provided by Herman and Baker (2005). Benchmark testing in mathematics and communication arts has become more popular as more school districts are desperate to boost student achievement to meet AYP as defined by NCLB in their state. Strong test design is a central theme. These authors provided a technical, yet sensible, process to follow for maximizing student achievement.

Research conducted in a large suburban district by Wisdom (2008) indicated that

monthly benchmark testing in mathematics in the upper elementary grades provides scores that form a strong, positive relationship to subsequent scores on state assessments. Benchmark tests provided by Tungsten Learning, Inc. administered two months prior to state testing provide an indication of probable student performance on the state exams.

A study carried out by the Oregon University System examined the relationship between student performance on 10th grade state assessments and subsequent first-year college grade point average. The study found close alignment between the 10th grade benchmark and academic performance during the first year of college. Students who met or exceeded benchmark scores on the Oregon state assessments were more likely to earn a higher grade point average. One conclusion of the study was that the 10th grade assessment could be used as a planning tool for the remaining two years of high school, prior to enrollment in the freshman year of college (Tell et al., 2003).

The Oregon State Assessment (OSA) system measured student performance in math knowledge and skills, math problem solving, reading/literature knowledge and skills, science, and writing. Oregon K-12 standards are aligned with admission standards to post-secondary institutions. Establishing Oregon State Assessment (OSA) scores as successful predictors of first-year college academic success allows some who normally would not plan for post-secondary study to do so (Tell et al., 2003).

The authors were able to establish a positive relationship between OSA scores and subsequent GPA through the use of linear regression analysis. Categories were established within the range of grade point average from 0.0 to 4.0, and OSA scores that were likely to predict achievement in a particular category of GPA were indicated. The probability predictions were attained through the use of a logistic regression (Tell et al.,

2003). The research completed by Tell et al. provides the ground work for this study since it indicates that assessment scores may indeed show a positive relationship to GPA.

A linear regression analysis determines if a relationship exists between independent and dependent variables, as it assumes a straight line fit within the data. Estimating a line of best fit allows for prediction of the dependent outcome when the independent information is a known variable (Creswell, 2002). A logistic regression does not follow the same process as a linear regression. A logistic regression analysis determines if a relationship exists between variables, sometimes considering multiple independent variables, while allowing for a non-linear relationship resulting in a curve to represent the best fit between data categories. This type of regression allows the probability prediction of a dichotomous outcome that indicates a category rather than a numerical result for the dependent variable (Hinton, 2004; Pezzullo & Sullivan, 2008).

Predicting Different Levels of Academic Success

Noble and Sawyer (2002) completed a study comparing the effectiveness of predicting first-year college GPA using high school GPA and ACT Composite scores. A positive relationship was found between the two variables. Using a logistic regression model, the researchers were able to effectively predict the level of college success represented by GPA. The researchers divided the GPA range of 2.0 to 3.75 into 5 point intervals and found that both high school GPA and ACT composite scores could successfully predict the category of college GPA likely to be earned. ACT composite scores were a stronger predictor than high school GPA. High school GPA scores above 3.00 provided a stronger prediction than those below 3.00. Noble and Sawyer also applied their prediction findings to student scores from different school years and in

attendance at different institutions. Thus, their study provided cross-validation across years and cross-validation across institutions.

Summary

A review of literature did not reveal information comparing middle school state assessments to subsequent performance in high school. However, there was a focus on factors related to high school grade point average such as student retention, graduation persistence, attendance, poverty, and gender and racial bias within school systems (Braunstein, Lesser, & Pescatrice, 2008; Steward, Steward, Blair, Jo, & Hill, 2008; Ward, Daughtry, & Wise, 2007). The most prominent emphasis in literature was the controversy surrounding high-stakes testing and subsequent data-driven decision processes.

High-stakes testing affects school policy in many districts. Attempts to increase student achievement on mandated state tests have forced districts to focus on school improvement plans that support instructional effectiveness. Decisions concerning use of teaching time and the spending of district funds are affected and are often a direct result of the previous year's district test scores.

In daily practice, high-stakes testing has forced administrators and classroom teachers to take a close, self-reflective look at processes for meeting student needs. In many cases, there have been creative and effective best practices developed with student achievement in mind. In many districts, a closer look at the alignment of instruction with state-developed learning goals has moved student achievement in a positive direction. Many districts that do not meet Adequate Yearly Progress (AYP) are still showing improvement in instructional technique and measured student progress.

Opponents of high-stakes testing believe that the focus on pushing student

achievement to higher levels is narrowing curriculum, causing learning activities to become repetitive, creating boredom within the classroom, and promoting an uninteresting, uninspiring setting for students. As a result, self-motivation and student accountability are lowered and a larger number of students become reluctant learners. Negative side effects cited have been high drop out rate, lower self-accountability among student population, and data manipulation by schools desperate to meet AYP.

Proponents of high-stakes testing are not unaware of the more undesirable side effects. These educators simply focus on a more positive acceptance of the inevitable. Schools are becoming more accountable for student learning and that accountability is measured by standardized testing in most states. The positive acceptance manifests itself as a creative approach to teaching technique and the analysis of available data to turn it into a tool. It is evident that data can be used to move effective learning in a positive direction. It is also evident that educators are capable of creative use of assessment tools.

Review of literature yielded a wealth of material exploring relationships and predictions comparing traits possessed by high school students, including their grade point averages, with success in coursework and adjustments to post-secondary work. There does not appear to be a similar amount available to help educators locate solid indicators of success for students transitioning from middle to high school.

Though grade point average (GPA) is not the only important product of the high school experience, it may be valuable to identify a predictor of GPA for use as an additional factor in identifying academically at-risk students at an earlier stage, allowing for earlier intervention to promote improvement and effective instructional program management. Early interventions help improve cumulative GPA, overall student

performance, scores on the American College Test (ACT), and a reduction in the achievement gap as defined through NCLB.

Though information to provide a direct connection between middle school state-mandated assessments and subsequent high school academic success was not found, the review of literature indicated that Reeves' (2006) statement of support for an early warning system providing identification of low performing students. His statement strengthened the rationale to search for a relationship and possible predictive connection between state-mandated assessments and high school academic success.

This study searching to establish the correlation between middle school Missouri Assessment Program (MAP) and cumulative, high school freshman-year Grade Point Average (GPA) was best suited for a causal-comparative analysis of data. The methodology for the study is outlined in the following chapter.

CHAPTER THREE – METHOD

This causal-comparative, correlation study analyzed the relationship between middle school Missouri Assessment Program (MAP) scores in Communication Arts and Mathematics and subsequent cumulative Grade Point Average (GPA) following the freshman year of high school. The purpose was to identify predictors of high school success, as measured by GPA.

All Missouri public schools participate in the MAP, which tests student academic progress toward a set of academic standards referred to as Grade Level Expectations (Missouri Department of Elementary and Secondary Education [MO DESE], 2006). Since all students in the population district participate in MAP, scores are available for all in the areas of Communication Arts and Mathematics. Scores should provide an effective tool for prediction of a student's relative success in the high school setting.

The MAP is a criterion-referenced assessment based on state academic Grade Level Expectations (United States Department of Education [DOE], 2008b). Findings that include a positive relationship between middle school MAP scores and freshman-year GPA will indicate effective alignment of district curriculum to state standards and effective Kindergarten through 12th grade (K-12) vertical alignment of academic content. Therefore, MAP scores should provide both prediction of student success as measured by high school GPA and an evaluation tool for assessment of effective curriculum placement within the district.

Identification of predictors of high school success may provide additional tools

for analysis that will lead to district improvement in meeting Adequate Yearly Progress (AYP) as required by provisions of the No Child Left Behind Act (NCLB). Early identification of academic risk allows time for implementation of programs to remediate and academically support identified students in need. Procedures may be placed to ease student transition from the middle school setting into high school. To provide for proper student placement within current programs and design appropriate future programs requires knowledge of the incoming student population. This study provided an analysis to support the use of middle school MAP scores as useful predictors.

As well as planning proper support for students who struggle academically, a tool for predicting high school GPA may help to effectively promote a higher level of achievement for a number of different types of learners. Early identification of student strengths may provide for planning proper challenges for average and gifted students, as well as those at academic risk.

Questions

The following questions were addressed in the study:

1. What is the relationship between middle school Missouri Assessment Program (MAP) scores in Communication Arts and freshman-year cumulative Grade Point Average (GPA)?
2. What is the relationship between middle school Missouri Assessment Program (MAP) scores in Mathematics and freshman-year cumulative Grade Point Average (GPA)?
3. What is the relationship between middle school Missouri Assessment Program (MAP) scores combined from the Communication Arts and Mathematics

categories and freshman-year cumulative Grade Point Average (GPA)?

4. What is the value of middle school Missouri Assessment Program (MAP) scores in predicting subsequent academic performance during the first year of high school?

Independent Variables

Communication Arts MAP scores. Eighth grade Communication Arts scores from the Missouri Assessment Program (MAP) were used as independent variables in this study.

Mathematics MAP scores. Eighth grade Mathematics scores from the Missouri Assessment Program (MAP) were used as independent variables in this study.

Combined Communication Arts and Mathematics MAP scores. The sum of scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) was an independent variable in this study. Scores earned during the eighth grade year were used.

Dependent Variable

High school Grade Point Average. The dependent variable in the study was the cumulative Grade Point Average (GPA) measured at the end of the freshman year of high school. The study considered the relationship between each of the independent variables and the dependent variable.

Hypotheses

Null hypothesis # 1. There is no significant correlation between eighth-grade Missouri Assessment Program (MAP) scores in Communication Arts and student success during the first year of high school enrollment, as measured using cumulative Grade

Point Average (GPA).

Null hypothesis # 2. There is no significant correlation between eighth-grade Missouri Assessment Program (MAP) scores in Mathematics and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Null hypothesis # 3. There is no significant correlation between sum of eighth grade scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Alternative hypothesis # 1. A positive correlation exists between eighth-grade Missouri Assessment Program (MAP) scores in Communication Arts and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Alternative hypothesis # 2. A positive correlation exists between eighth-grade Missouri Assessment Program (MAP) scores in Mathematics and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Alternative hypothesis # 3. A positive correlation exists between the sum of eighth grade scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) and student success during the first year of high school enrollment, as measured using cumulative Grade Point Average (GPA).

Participants

The population for the study was selected from one of two high schools in a large

suburban school district. Located in a suburb of St. Louis, MO, the school serves an enrollment of approximately 2100 students in grades 9 through 12. Demographics for the school and district for the two years accessed for the study are shown on Table 1. For 2006 and 2007 respectively, the study site high school is represented by 87.7% and 87.8% White, 11.0% and 10.8% Black, with 11.6% Free and Reduced Lunch for both years (MO DESE, 2008b).

Table 1

Demographics: Study Site School District and Senior High School.

	School District		Senior High School	
Year	2006	2007	2006	2007
Enrollment	11308	11084	2032	2037
% Asian	2.1	2.3	0.8	0.9
% Black	12.2	11	11	10.8
% Hispanic	0.8	1	0.4	0.4
% Indian	0	0	0	0.3
% White	84.9	85.6	87.8	78.4
% Free / Reduced Lunch	21.3	20.3	11.6	11.6

Note: From Missouri Department of Elementary and Secondary Education (2008b)

Table 2 lists the district enrollment and number of certified staff for the ten elementary schools, one early childhood center, four middle schools, and two high schools. Total district enrollment in both high schools combined is 3979 students served by 240 certificated staff (MO DESE, 2008b).

Table 2

School District Enrollment Demographics

	Schools	Certificated Staff	Total Enrollment
Elementary	11 [1 EC]	333	4644
Middle Schools	4	170	2582
Jr. High Schools	0	0	0
High Schools	2	240	3979
Total	17	743	11205

Note: From Missouri Department of Elementary and Secondary Education (2008b)

This study analyzed the correlation between eighth-grade MAP scores in Communication Arts and Mathematics and GPA at the end of the freshman year of high school enrollment. The two most recent classes of ninth graders were selected for the study. The class of 2011 completed the ninth grade during the 2007-2008 school year with an enrollment of 522, and the class of 2010 completed the ninth grade during the 2006-2007 school year with an enrollment of 468.

Grade Point Average and Student Success

For the purpose of this study, the high school cumulative GPA was used as an indicator of academic success. In defining levels of student academic success, consideration was given to the decision-making value of GPA. A minimum cumulative GPA of 3.3 is required for membership in National Honor Society (National Honor Society, 2008). Dual credit programs allowing students to earn college credit and high school credit simultaneously for one course require a cumulative GPA of 3.0 & above

(MSD, 2008, p. 9; Saint Louis University [SLU], 2008). Some institutions in the state of Missouri base admission decisions upon several criteria, which include class rank calculated using cumulative GPA (University of Missouri [MU], 2008; Webster University [WU], 2008). Academic scholarship decisions include a consideration of cumulative GPA (MU, 2008; SLU, 2008; WU, 2008).

This study defined levels of high school success using categories of cumulative GPA. The widely accepted, un-weighted GPA scale assigns a value of 2.0 to a letter grade of *C*; a value of 3.0 to a letter grade of *B*; and a value of 4.0 to a letter grade of *A* (MSD, 2008; MU, 2008). GPA categories examined in the study were 2.0 & above; 2.5 & above; 3.0 & above; 3.5 & above; and 3.75 & above.

Strategies Applied in This Study

This study applied a multiple regression analysis to data to analyze the predictive nature between variables. Data are discussed with reference to the Pearson Correlation Coefficient. To further analyze data for the strength of predicting which GPA category a student may achieve at the end of the freshman year, a logistic regression model utilizing conditional probabilities was applied.

Pearson Correlation Coefficient

The statistic that expresses correlation " . . . as a linear relationship is the Pearson product-moment correlation coefficient . . . " (Creswell, 2002, p. 370). Referred to as the Pearson Correlation Coefficient, this statistic allows the researcher to describe the extent to which the data fit a linear model. The coefficient ranges in value from -1 to +1. Zero indicates no relationship between the independent and dependent variable (Gay & Airasian, 2003, p. 313). A negative number indicates a negative relationship between the

two and a positive number represents a positive relationship (p. 313). A positive correlation indicates that an increase in the independent variable will yield an increase in the dependent variable, as well (p. 313). A value of one indicates a perfect relationship between the two variables (p. 313).

The closer the coefficient is to the value of one, the closer the variable values are to fitting a perfectly straight line when graphed on the x-y coordinate plane (Hinton, 2004). A close fit to a straight line indicates a high probability that the dependent value can be predicted from the independent value (Hinton, 2004). This study analyzed data for predictability using the Pearson Coefficient.

The use of the Pearson Coefficient infers a judgment concerning the strength of relationship between variables. The coefficient supports statistical conclusion validity, which refers to " . . . the validity with which we can infer that two variables are related and the strength of that relationship" (Johnson & Christensen, 2004, p. 229). Creswell (2002) stated that the Pearson Coefficient is used to " . . . determine the magnitude of association between two variables and to detect the direction (the sign, "+" or "-") of a relationship" (p. 370). Correlation coefficients below plus or minus 0.35 indicate a low or nonexistent relationship (Gay & Airasian, 2003, p. 314). Those between plus or minus 0.35 and 0.65 indicate that variables are moderately related (Gay & Airasian, p. 314). Coefficients higher than plus or minus 0.65 indicate that variables are highly related (Gay & Airasian, p. 314).

Multiple Regression Analysis

A multiple regression method is used when checking for one variable predicting another. "Multiple regression (or multiple correlation) is a statistical procedure for

examining the combined relationship of multiple independent variables with a single dependent variable" (Creswell, 2002, p. 376). Data in each of the categories should be close to normally distributed (Hinton, 2004). An examination of the MAP and GPA data used in this study indicated a distribution close to normal (see Figure B2).

A multiple regression analysis checks for a direct relationship between the independent and dependent variables. When a direct relationship exists, an equation for a line of best fit is generated. The equation allows the use of a piece of data from the independent variable category to calculate, or predict, the expected value in the dependent variable category (Hinton, 2004). A percentage, given by the R^2 value (square of the Pearson Coefficient), describes the expected rate at which the independent data will accurately predict the dependent data. Hence, the study provides a picture for the researcher of how useful the examined tool is as a predictor for the desired characteristic (Hinton, 2004). For example, a multiple regression analysis will allow a researcher to conclude a statement such as the following: with 95% confidence we can state that 46% of our dependent data can be predicted or explained by the independent data.

Logistic Regression Analysis

A Logistic Regression Model is used with a dichotomous dependent variable. Logistic regression allows a model in which the impact of the independent variable on the dependent variable depends on its value (O'Halloran, 2008). This process differs from linear regression which presents a description of a positive, negative, or zero relationship between the independent and dependent variables using a continuous range of values in the dependent variable (Hinton, 2004). The logistic model provides a description of the strength of prediction of the dependent variable provided by the independent variable.

In this study the dependent variable was treated as dichotomous in the assignment of GPA categories. Either the dependent variable is listed in the examined category or it is not. The treatment of the independent variable also used categories of description. The student scored appropriately to be placed in the proficient or advanced category of MAP, or he or she did not. The value of the dependent variable, yes or no, depends on the original value of the independent variable, yes or no. A conditional probability foundation allows the researcher an evaluation of the predictability of the dependent variable, given information about the independent variable.

This study presented data to meet the specifications of the use of a logistic model. The model is correctly specified to include the following: (a) The true conditional probabilities are a logistic function of the independent variables; (b) No important variables are omitted; (c) No extraneous variables are included; and (d) The independent variables are measured without error. Also, the cases are independent and the independent variables are not linear combinations of each other (O'Halloran, 2008).

When examining a graph of the independent variable to the probability of meeting the dependent descriptor, $p = .50$ is the cutoff value for considering a successful prediction. Logistic models using conditional probabilities frequently provide odds ratios in predicting a dependent variable outcome when presented with an independent variable value (O'Halloran, 2008). Data in this study were treated with a calculation of probability.

A multiple regression analysis determines if a relationship exists between independent and dependent variables, as it assumes a straight line fit within the data. Estimating a line of best fit allows for prediction of the dependent outcome when the

independent information is a known variable (Hinton, 2004). A logistic regression determines if a relationship exists between variables, sometimes considering multiple independent variables, while allowing for a non-linear relationship resulting in a curve to represent the best fit between data categories. This type of regression analysis allows the probability prediction of a dichotomous outcome that indicates a category rather than a numerical result for the dependent variable (Pezzullo & Sullivan, 2008).

Cross-Validation of Results

This study developed a logistic model of conditional probabilities (Noble & Sawyer, 2004) calculated using baseline-year data from the class of 2011. " . . . Because of the lack of control and manipulation in correlational research, it is advisable to cross-validate the results of correlational analysis with a separate, independent sample" (Mertens, 1998, p. 99). Gay and Airasian (2003) stated that " . . . any prediction equation should be validated with at least one other group, and variables no longer found to be related to the criterion measure should be taken out of the equation" (p. 321). To provide cross-validation, the model was then applied to data from the class of 2010 who were freshmen in the following school year (Noble & Sawyer, 2004). A comparison of results from the two separate sets of data allowed a check for consistent measurement.

Logistic Model and Cross-Validation Process

This study followed a logistic model similar to one used in a study by Noble and Sawyer (2002), which predicted levels of success in the college setting using GPA as a measure. The study completed by Noble and Sawyer used college level GPA; however, this study claimed that knowledge of the middle school MAP category level would allow a prediction of subsequent high school, freshman-year GPA category. Three descriptive

calculations were provided. The Category Accuracy Rate (CAR) of predicting the outcome for each GPA category was provided (Noble & Sawyer, 2002). Increased Category Accuracy Rate (ΔCAR) using a student MAP score as a predictor were provided through comparison of category accuracy using historical baseline data for the population as a predictor instead of MAP category level (Noble & Sawyer, 2002). The Success Rate (SR) in using the prediction model was provided (Noble & Sawyer, 2002). The model was developed using data from the class of 2010 (2006-2007 freshmen). The model's effectiveness was cross-validated (Mertens, 1998) by applying calculations to data from the class of 2011 (2007-2008 freshmen).

Similar Study

Review of literature did not provide studies using predictor models for high school grade point average (GPA) dependent upon middle school state assessment scores; however, studies were found providing predictor models for college success as measured using GPA.

The Oregon University System sponsored a study directed by Christine Tell (2003) comparing 10th grade state benchmark assessments in five categories to subsequent GPA during the freshman year of college enrollment. Pearson correlation coefficients were provided for each of the five categories, along with subcategories, for an analysis of relationship to five categories of GPA earned during the freshman year (Tell et al.). Probabilities were calculated to allow prediction of which GPA category would be attained by a student from each level of achievement on the benchmark assessments (Tell et al.).

Julie Noble and Richard Sawyer (2002) conducted a study comparing High

School Grade Point Average (HSAV) and American College Test (ACT) scores to subsequent freshman-year, college GPA. Pearson correlation coefficients and a discussion of an initial check of data for its fit to a linear regression model were provided. Conditional probabilities and a logistic model are applied to develop and check reliability of prediction of college GPA depending upon HSAV and ACT category levels. Noble and Sawyer cross-validate findings from their study by applying prediction results to data from numerous institutions during a two-year time span.

Method Applied in This Study

Findings from two studies by Tell et al. (2003) and Noble & Sawyer (2002) provided the basis for the choice of model used in this study. Pearson correlations coefficients were calculated and analyzed for three categories of independent variables, applied separately. Data were checked for a positive relationship to the dependent variable using a linear regression model. A logistic model for prediction utilizing conditional probabilities was devised providing calculations intended to describe the accuracy of prediction, the effectiveness of using MAP level categories as predictors, and the success rate of the model in providing accurate prediction (Noble & Sawyer, 2002). The prediction model was developed using data from the class of 2011 and then applied to data from the class of 2010 to provide cross-validation over a two-year time span (Mertens, 1998).

Sampling Procedure

Eighth-grade MAP scores and freshman GPA data were collected from the study site District School Information System (SIS) for the classes of 2010 and 2011. Each student name was matched with the appropriate eighth grade Communication Arts and

Mathematics scores and freshman year GPA. This process completed a data set for each candidate to be entered into the population that would provide the random sample for the study.

To address limitations of the study and maximize the generalization of results, incomplete data sets were removed. Student data sets were removed if one of the two eighth-grade MAP scores was not available. English language learners introduce factors that are not within the scope of this study. Scores for these students were manually removed from the list. The remaining population provided 743 data sets.

All data sets were combined into one list. The list was sorted to represent GPA as listed from highest to lowest. The list was numbered. A random number generator was used to obtain 45 randomly selected values (Urbaniak & Pious, 2007). Data sets numbered with those 45 values became the sample used for the multiple regression analysis. The suggested sample size is 15 to 20 pieces of data for each independent variable in the study (Hinton, 2004, p. 106). Gay and Airasian (2003) stated that " . . . 30 participants are generally considered to be a minimally acceptable sample size" (p. 312). A large sample size, which approaches the size of the entire population, can introduce error into the interpretation of analyzed data (Hinton, 2004, p. 106).

Calculation of the logistic model was completed for each class separately. Removal of incomplete data sets from each class left 414 in the population of the class of 2010 and 329 in the population of the class of 2011. From the remaining complete data sets, conditional probabilities were calculated for the baseline year and then compared to conditional probabilities calculated for the cross-validation year.

External Validity of the Study

Four main categories were considered with regard to the external validity of this study. The type of assessment generating the scores used as independent variables, the process used for calculation of grade point average, the type of coursework taken by high school freshmen, and district demographics should be considered before applying the same procedure to a different population.

Assessment scores used for this study were from the Communication Arts and Mathematics categories. Scores were achieved through participation in the MAP. Tests are criterion-referenced and based on state standards (MO DESE, 2007).

The freshman year GPA was considered in this study. GPA was calculated using a four point scale ("Academic", 2008). The possible range for GPA is 0.0 to 4.0. There were no weighted grades considered (MSD, 2008, pp. 14-21).

Typical freshman enrollment at the study site includes four core courses, one foreign language, one health or physical education, and one fine art elective (MSD, 2008, p. 12). The similarity in freshman scheduling throughout the district allows the researcher to limit factors introduced by a wide variety of course exposure and a large list of instructors accessing the population used in the study. District requirements for the high school diploma are listed in Table 3.

Data were gathered from the ninth grade year for students enrolled in a large, suburban high school serving four district middle schools. District population represented limited diversity. Ethnic representation was 88% White, 11% Black, and 1% Asian, Indian, and Hispanic. The population included 11.6% free and reduced lunch students (MO DESE, 2008b). Though not largely diverse, the population represents the

geographic region.

Table 3

Class of 2010, 2011, 2012 Diploma Requirements

	Unit(s)
Communication Arts (English I, II, III and IV)	4.0
Social Studies (American Government, World Studies and American Studies)	3.0
Mathematics	3.0
Science	3.0
Fine Arts	1.0
Foreign Language or Second Fine Arts	1.0
Practical Arts	1.0
Physical Education	1.0
Health	0.5
Personal Finance	0.5
Total Required Units	18.0
Electives (chosen from any area)	7.0
Total Graduation Units	25.0

Note: From Mehlville School District (2008), p. 3.

Threats to the external validity of this study include population, ecological, temporal, and treatment variation validity (Johnson & Christensen, 2004, pp. 243-246). Population validity refers to " . . . the ability to generalize from the sample of individuals

on which the study was conducted to the larger target population . . . " (Johnson & Christensen, 2004, p. 242). The random sample taken from one high school in the district exhibits similar demographics to the second high school in the district and to large, suburban public school districts located in the region. Diversity of the population is limited.

Ecological validity refers to " . . . the ability to generalize the results of a study across settings" (Johnson & Christensen, 2004, p. 245). The setting for this study is a large, suburban public school district. Different socio-economic and financial settings throughout the rural areas of the state limit the strength of generalizing to populations in those locales.

Temporal validity, which refers to " . . . the extent to which the results of a study can be generalized across time" (Johnson & Christensen, 2004, p. 245) is naturally limited by the predetermined testing windows for administration of the MAP assessment. Other times of the year and other grade levels from which to extract data are not usually available (MO DESE, 2007). This assessment window is typical of the state of Missouri and affects all districts participating in the state-designed assessment.

Treatment variation validity refers to " . . . the ability to generalize the results across variations of the treatment" (Johnson & Christensen, 2004, p. 245). MAP assessment administration is described in detail in the administrator's manual (MO DESE, 2008a). Training is provided for district teachers in the administration of the tool. Treatment variation has been well controlled in this study.

Results could possibly be generalized to large, suburban Missouri school districts with majority White and minority Black enrollment. GPA should represent freshman data

on a 4.0, un-weighted scale. Data from scores on MAP Communication Arts and Mathematics tests taken during the spring of the middle school years should be compared to freshman-year GPA. Rather than generalize the results from this study, a district should construct its own baseline data and conduct a similar study. Efforts to control the threats to external validity of the study were made. Some factors, such as population diversity do not lend themselves to the generalization of the study results.

Considerations in the Study Procedure

In choosing independent and dependent variables, consideration was given to middle school data likely to have a predictive link to freshman-year, high school student success. Missouri Assessment Program (MAP) Communication Arts and Mathematics scores were chosen as the independent variables and freshman-year GPA was chosen as the dependent variable.

Choice of population was determined following consideration of consistent treatment of the chosen variables over a time span of two school years. The number of credits required for high school graduation had recently changed. Two consecutive school years were needed in which the same credits for graduation were required. Participant data also indicated enrollment in similar freshman-level courses. Cross validation over a wider time span would strengthen research design. However, a window of time was needed in which MAP assessment and state content standards did not undergo major change. The two-year time span used in this study allowed for this stability.

Data considerations included an examination of the process for determining GPA. No change in the process used to calculate GPA occurred between year one and year two. Data for the two years represented the same system of MAP Level categorization. Five

levels were assigned by the state assessment department. Advanced (5) and Proficient (4) were the desired achievement categories. Basic (2) and Below Basic (1) were the undesired achievement categories. Category 3, located between the desired and undesired achievements, was not treated in this study. The unchanged state of the GPA calculation over the span of two years allowed limitation of threats to the validity of the study.

Consideration of the state assessments included the requirement that no major change in state standards was represented when comparing year one to year two. The same type of state assessment was used during both years. No end-of-course exams provided data for the study. The state assessments and standards did not change over the course of the two year time span chosen for the study.

Desirable range on MAP Communication Arts and MAP Mathematics was defined as a reflection of meeting Adequate Yearly Progress (AYP) for No Child Left Behind (NCLB). The district was supporting students as they reach for MAP Level Advanced (4) or Proficient (5). This study examined the number of students in MAP categories 4 and 5 who met successful GPA categories and the number of students in MAP categories 1 and 2 who did not meet successful GPA categories.

Definition of the successful student, measured using GPA, followed consideration of the use of letter grades in the high school setting. The letter grade of *D* will earn credit toward high school graduation. One of four major board approved educational goals at the study site has been "To have 100% of . . . District students graduate" (MSD, 2008, p. i). A grade of *C* is assigned to students who complete work with an average ability. GPA categories 2.0 and above were considered in the study and were divided into individual, dichotomous categories for consideration. Five GPA categories were defined:

3.75 & above; 3.5 & above; 3.0 & above; 2.5 & above; and 2.0 & above.

Statistical Treatment of Data

Data were treated with a stepwise multiple regression analysis. Following the establishment of a significant correlation between each independent variable and the dependent variable, a logistic regression model was applied. A logistic model using conditional probabilities was chosen similar to the study by Noble & Sawyer (2002). Data were separated into the two classes 2011 and 2010 and into individual MAP level categories achieved by the students. For each GPA category, the number of students in each MAP level category was counted and recorded. The percent of students from the population represented in each GPA category was calculated. This base line percentage number was used for comparison to the following calculations obtained using conditional probabilities: Category Accuracy Rate (CAR), Increase in Category Accuracy Rate (ΔCAR), and Success Rate (SR). Conditional probabilities were constructed by first dividing data sets into those students who scored Proficient and Advanced on MAP assessments and those who did not. With that condition set, calculations were performed to represent the percent of students who subsequently achieved in each of the defined GPA categories.

Conditional Probability Model

The logistic model developed in this study was designed using conditional probabilities and is similar to that utilized by Noble & Sawyer (2002). Calculations, as described below, were performed to provide a base line percentage, a category accuracy rate, an increase in category accuracy rate, and a success rate. The success rate allowed a description of the usefulness of using the conditional probabilities as predictor values.

Base Line Percentage. The baseline percentage represented the percent of the student population in each GPA category regardless of original MAP category achieved.

Category Accuracy Rate (Noble & Sawyer, 2002). For each MAP category, the number of students in each GPA category was divided by the number of students achieving in that specific MAP category (Noble & Sawyer, 2002). This value indicated the percent of students with the predetermined MAP category that were also represented in each GPA category. The value allowed a comparison to the baseline percentage for each GPA category (Noble & Sawyer). A Category Accuracy Rate (CAR) value larger than the baseline percentage indicated the strength of using MAP categories as a condition to predict the subsequent GPA category likely for the student (Noble & Sawyer).

Increase in Category Accuracy Rate (Noble & Sawyer, 2002). The CAR was calculated for each GPA category for successful students and for each GPA category for unsuccessful students. The maximum difference between these percentages and the baseline percentage is Increase in Category Accuracy (Noble & Sawyer, 2002). A large number indicated the increased effectiveness of using the Map category as a predictor, as compared to using the baseline percentage alone, of the number of students likely to achieve that particular GPA category (Noble & Sawyer, 2002).

Success Rate (Noble & Sawyer, 2002). Success Rate (SR) was calculated by dividing the number of students actually in the GPA category by the number of students predicted to be in the category (Noble & Sawyer, 2002). This value indicated how successful the MAP category was as a condition to predicting the number of students to achieve in each GPA category (Noble & Sawyer, 2002).

Cross-Validation (Mertens, 1998). The same logistic model was used to calculate conditional probabilities for the class of 2010. The model was then cross-validated comparing SR results from the two groups to each other, category by category, for each MAP score (Noble & Sawyer, 2002).

Two different sets of freshman students generated the MAP scores and GPA scores analyzed in this study. Conditional probabilities were calculated for each set separately. The analyses were compared for similarities. Similar patterns indicate internal reliability of results of the study. Calculations included a base line percentage of the number of students in each defined GPA category without first considering the MAP score achieved in Communication Arts and Mathematics. Then a category accuracy rate was calculated by first separating students into those achieving the desired Proficient and Advanced ratings. An increase in category accuracy was found by subtracting the category accuracy rate and the base line rate. A success rate for prediction was found by dividing the actual number of students in the GPA category by the expected number formed by the probability prediction. A high number in the success rate column is desirable.

Reliability and Validity of Instrumentation

The instruments for measurement used in this study were the Missouri Assessment Program (MAP) and freshman-year Grade Point Average (GPA). Reliability and validity of the MAP are addressed by the Missouri Department of Elementary and Secondary Education (MO DESE, 2008c).

Reliability is defined as " . . . the ability of a measuring instrument to measure the concept in a consistent manner" (Hinton, 2004, p. 301). Validity examines whether or not

the chosen tool actually measures the intended construct (p. 301). "Deciding on the validity of a measure is an academic issue rather than one for statistical analysis" (p. 301).

The Missouri Department of Elementary and Secondary Education (MO DESE) verified the validity of MAP scores used as " . . . indices of proficiency relative to the Show-Me Standards by using methodical and rigorous test-development procedures" (MO DESE, 2008c, p. 3). The agency also indicated confidence in the validity of the MAP assessment through use of item and pattern analysis. "The various item-and score-pattern analyses conducted on MAP results show that each assessment is measuring the traits it is intended to measure…and does not measure unrelated constructs" (MO DESE, 2008c, p. 3).

Reliability was addressed in agency efforts to develop " . . . high quality instruments that will yield dependable . . . " scores (MO DESE, 2008c, p. 4). Reliability coefficients are calculated using scale scores as data. A coefficient close to 1 is desirable (MO DESE, 2008c, p. 4).

Reliability and validity of cumulative grade point average were difficult to document in literature. Many factors influence the assignment of grades to student coursework. The scale used in this study was the widely accepted, un-weighted grade point average ("Academic", 2008).

The instruments used in this study were the Missouri Assessment Program (MAP) scores for Communication Arts and Mathematics and cumulative freshman-year Grade Point Average (GPA). Though the reliability of GPA as a measurement is difficult to document, control of limiting factors in the study improves the reliability of GPA as a

measuring tool. MAP scores are continually observed and analyzed for reliability by MO DESE.

Threats to Internal Validity

Since a study of correlation does not apply an intervention, there are threats to internal validity that do not usually apply. These threats are implementation, history, maturation, attitude of subjects, and regression threats (Fraenkel & Wallen, 1990, p. 285). In this study, since one year passed between the application of the middle school MAP assessment and the recorded GPA, maturation was discussed as a potential limitation. Threats to internal validity that should be considered for a correlation and for a causal-comparative study (Fraenkel & Wallen, 1990, pp. 285-311; Johnson & Christensen, 2004, pp. 236-238) are location, instrumentation, testing, and mortality.

A location threat to internal validity was possible. The MAP assessment is administered to district students during a short, predetermined time window. Students participate at the school in which they are enrolled. The location of assessment can be one of the four district middle schools. Within the school, different rooms and test proctors administer the exams. Attempts are made to control processes for administration of the exam; however, different routines and noise levels may occur because of student location.

Other threats to internal validity that should be considered do not apply to this study. The instrumentation threats of instrument decay, data collector characteristics, and data collector bias (Fraenkel & Wallen, 1990, p. 287) were not an issue. Data were collected from student files. There was no personal interaction by the researcher with the randomly chosen sample. Mortality (Fraenkel & Wallen, 1990, p. 287) was not an issue.

The random sample was selected using data from which incomplete sets were removed. The original random sample chosen was the same one that provided middle school MAP scores and GPAs used in analysis.

Threats to internal validity that apply to this study are maturation and location. Since the study is concerned with transition from middle to high school, middle school MAP scores are correlated with high school GPA. There is a natural maturation process between generations of data sets. To minimize this threat, eighth grade MAP scores are compared to ninth grade GPA. A natural time span of one year elapsed between data collection. Location threat is difficult to control, but easy to minimize. The study site represents a large school district, but the researcher was able to limit the number of schools with students generating data used in the study. Two middle schools and one high school were involved in data gathering.

Efforts to Control Limitations of the Study

This study was limited by maturation of the population and subsequent random groupings, varied instructional delivery of district curriculum, and effects of multiple testing environments. To minimize the extent of the effects of maturation, this study used data from MAP administration during the spring of the eighth grade year compared to student GPA at the end of the freshman year. The effective time span was one year. To minimize the effects of varied instructional delivery, a sample was chosen from one single building within one school district. The middle school MAP scores represent historical data gathered prior to the proposal of this study. Differences in instructional delivery prior to assessment cannot be addressed. The number of different high school courses and instructors accessed by the sample used for the study was reported. Efforts to

control limitations of the study were addressed by choosing a student population from one building within the district.

All subjects took the same MAP exams during the district testing window. Tests were administered by multiple proctors in multiple settings. Proctors received instructions for administering the exams, so difference in test administration was minimal. Individual differences in environment were not controlled; however, efforts were made to isolate rooms where students were testing. Efforts to control limitations of the study included (a) the choice of freshman year GPA to include in the analysis, (b) the choice of eighth grade MAP correlation to ninth grade GPA, and (c) cross-validation of study data to ensure reliability.

Incomplete data sets. Students who did not participate in both Communication Arts and Mathematics assessment in middle school were removed. Students with a learning disability or special needs received an alternate assessment. Scores from the alternate assessment were not recorded in the file accessed by the researcher to gather MAP Communication Arts and MAP Mathematics scores. These students appeared to have an incomplete data set for purposes of the study and were removed.

Grade Point Average (GPA) used as a success measure. Though GPA is calculated using the same method for all students in the district, each individual student's course selection throughout the four years of high school may differ (MSD, 2008, p. 12). To address this potential limitation, the researcher chose freshman-level GPA as the dependent variable. Freshmen have very little free elective choice in course selection for the year. The same core courses were required of all freshmen in the district (p. 12). Differentiated instruction was provided through offering three levels of rigor for

coursework: concepts, regular, and honors.

A number of items were considered to control threats to internal validity. Maturation was limited to a one-year time span by choosing eighth grade MAP scores and ninth grade GPA. Diversity of coursework and instructional delivery were limited to freshman year and one district school building. Statistical treatment of data was cross-validated over a two-year time span.

Confidential Treatment of Data

Individual student data was not divulged to any educational institution or persons. Once information was disaggregated and random selection of students to be included in the study was completed, there was no need for individual identification. Student names and scores have not been published. District privacy policy follows regulations written within constraints of the Family Educational Rights and Privacy Act (DOE, 2007).

Summary

This study investigated the relationship between eighth grade Communication Arts (CA) and Mathematics (MA) scores from the Missouri Assessment Program (MAP) and subsequent freshman year grade point average (GPA). Data for freshmen from two consecutive years were gathered from enrollment in a large high school in a suburban school district near St. Louis, MO. Demographics of the school represent a population that was 88% White and 11% Black, with 11.6% of the population in the free and reduced lunch category (MO DESE, 2008b).

Incomplete data sets, English Language Learners, and students with learning disability were removed from the information. Data were treated with a multiple regression analysis that revealed a positive relationship between each independent

variable (MAP CA and MA) and the dependent variable (freshman-year GPA).

A logistic regression model was constructed to check for predictability in the data provided by the class of 2011. Conditional probabilities allowed an examination of predicting Category Accuracy Rate (CAR) when previously knowing the MAP Level of the student (Noble & Sawyer, 2004). An examination of accuracy rate using MAP as a predictor was compared to the probability of a student landing in the examined GPA category without the predictor. This analysis allowed a decision about the usefulness of the prediction tool (Noble & Sawyer, 2002). Using a baseline percentage rate to calculate the number of students expected in each GPA category, the success rate of using the MAP score as a predictor was calculated. This calculation allowed an analysis of the effectiveness of using a MAP CA or MAP MA or combined MAP scores to predict the subsequent freshman year GPA (Noble & Sawyer, 2002).

To check the reliability and provide cross-validation of the model used, the same process was followed using data provided by the class of 2010. A comparison of success rates between the two years provided an analysis of the effectiveness of the prediction indicator and the reliability of the model (Noble & Sawyer, 2002).

The study was limited by the demographic characteristics of the population provided. The study procedure was adjusted to minimize the limitations of maturation, instructional delivery, and use of grade point average to define student success.

Discussion of this study continues in the next chapter with an analysis of data and its statistical treatment.

CHAPTER FOUR – RESULTS

This study analyzed the relationship between middle school Missouri Assessment Program (MAP) scores in Communication Arts (CA) and Mathematics (MA) and subsequent cumulative Grade Point Average (GPA) following the freshman year of high school. The purpose was to identify predictors of high school success, as measured by GPA. Based upon assessments designed around state approved-content standards, MAP scores should provide an indication of a student's tendency toward appropriate content knowledge and study skill strength in core academic areas.

Middle school Communication Arts MAP scores and Mathematics MAP scores were the independent variables in the study. The dependent variable was cumulative GPA following the freshman year of enrollment in high school. Eighth-grade MAP scores and freshman GPA data were collected from the study site District School Information System (SIS) for the classes of 2010 and 2011 (see Table A3). These students were enrolled in ninth grade during the 2006-2007 and 2007-2008 school years, respectively. Data was analyzed to establish the correlation between middle school MAP scores and freshman-year GPA.

Participants

The study site was a large, suburban district located in south St. Louis County, Missouri. Four middle schools provided enrollment for two high schools serving over 2000 students each. The district population represented limited diversity. Ethnic representation was 88% White, 11% Black, and 1% Asian, Indian, and Hispanic. The

population included 11.6% free and reduced lunch students (MO DESE, 2008b). Population diversity is a limitation of this study. Efforts to control the limitation included the use of a population from one single school building in one single district.

Table 4 summarizes the population descriptive statistics for the independent and dependent variables analyzed in the study. The random sample represented an average freshman-year GPA of 2.99 and average middle school MAP Communication Arts and Mathematics scores of 698 and 716, respectively.

Table 4

Random Sample Descriptive Statistics

	Mean	Standard Deviation
Cumulative GPA	2.99	0.791
MAP CA Score	698.98	41.923
MAP MA Score	716.89	37.570
Combined CA & MA Score	1415.87	75.885

Note: GPA = Grade Point Average. MAP = Missouri Assessment Program. CA = Communication Arts. MA = Mathematics. n = 45. Confidence Level = .95

The students represented in the Base Line year data were freshmen during the 2006-2007 school year. As sophomores, they participated in the state MAP Mathematics assessment. Tenth grade MAP Mathematics scores were not utilized in this study; however, a chart summarizing the tenth grade results in MAP Mathematics is provided in Figure B1 for comparison to MAP Mathematics middle school results. The study did not address English Language Learners, learning disabled students who participated in the alternate MAP, and students who transferred into the population district for ninth grade

following eighth grade attendance outside the district.

Over the span of the two years considered in the study, ninth grade students were dispersed among different classes taught by different teachers. The distribution of the random sample among 12 different English teachers is summarized in Table A1. The distribution among 11 different mathematics teachers is summarized in Table A2. Approximately 85% of the random sample representing ninth grade students was taught by the same set of seven English teachers and seven mathematics teachers over the two year span of this study.

Table 5 indicates the ninth-grade English class enrollment of the random sample. The courses English I and English I Enriched were attended by 42 of the 45 random sample members. The random sample is representative of the study population. Approximately ninety-six percent of the population is enrolled in English I and English I Enriched.

Table 5

Random Sample Distribution
Enrollment in Freshman English Courses

English Course	# students
English Lab	1
Reading Lab	1
English I Enriched	11
English I	31

Note: Two year time span used. n = 45.

Mathematics courses attended by members of the random sample are summarized

in Table 6. Algebra I and Advanced Algebra I were attended by 26 members while Advanced Algebra II and Honors Algebra II / Trigonometry were attended by 12 of the 45 random sample members. The majority of the study population was enrolled in Algebra I and Advanced Algebra I.

Table 6

Random Sample Distribution

Enrollment in Freshman Mathematics Courses

Mathematics Course	# students
Algebra Foundations	1
Math Class	1
Pre-Algebra	4
Honors Algebra II / Trig	6
Advanced Algebra II	6
Advanced Algebra I	10
Algebra I	16

Note: Two year time span used. N = 45.

Treatment of Data

A stepwise multiple regression analysis was applied to determine if correlations between independent and dependent variables were significant. Following this analysis, data were further analyzed with a logistic model based on conditional probabilities. This model allowed an exploration of the potential predictive nature of the data in which the researcher chose the MAP level category and then examined the subsequent GPA 97

category achieved by the student. Predetermined GPA categories chosen for analysis were 2.0 & above; 2.5 & above; 3.0 & above; 3.5 & above; and 3.75 & above.

Results and Analysis of Data

Multiple Regression Analysis

The multiple regression analysis addressed the following questions and related hypotheses.

1. What is the relationship between middle school Missouri Assessment Program (MAP) scores in Communication Arts and freshman-year cumulative Grade Point Average (GPA)?
2. What is the relationship between middle school Missouri Assessment Program (MAP) scores in Mathematics and freshman-year cumulative Grade Point Average (GPA)?
3. What is the relationship between middle school Missouri Assessment Program (MAP) scores combined from the Communication Arts and Mathematics categories and freshman-year cumulative Grade Point Average (GPA)?

Null hypothesis # 1. There will be no significant correlation between eighth-grade Missouri Assessment Program (MAP) scores in Communication Arts and student success during the first year of high school enrollment, as measured by cumulative Grade Point Average (GPA).

Null hypothesis # 2. There will be no significant correlation between eighth-grade Missouri Assessment Program (MAP) scores in Mathematics and student success during the first year of high school enrollment, as measured by cumulative Grade Point Average (GPA).

Null hypothesis # 3. There will be no significant correlation between the sum of eighth grade scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) and student success during the first year of high school enrollment, as measured by cumulative Grade Point Average (GPA).

Alternative hypothesis # 1. A positive correlation will be found between eighth-grade Missouri Assessment Program (MAP) scores in Communication Arts and student success during the first year of high school enrollment, as measured by cumulative Grade Point Average (GPA).

Alternative hypothesis # 2. A positive correlation will be found between eighth-grade Missouri Assessment Program (MAP) scores in Mathematics and student success during the first year of high school enrollment, as measured by cumulative Grade Point Average (GPA).

Alternative hypothesis # 3. A positive correlation will be found between the sum of eighth grade scores from the Communication Arts and Mathematics categories of the Missouri Assessment Program (MAP) and student success during the first year of high school enrollment, as measured by cumulative Grade Point Average (GPA).

The stepwise multiple regression indicated a correlation significant at the .01 level for each of three independent variables. Each of the three null hypotheses was rejected, and hence, each of the three alternative hypotheses was concluded to be true. Mathematics scores were indicated as the strongest independent variable. Stepwise multiple regression analysis adds an additional independent variable to the next calculation of the correlation value (R). This tests the possibility that the use of the two or more variables together will yield a stronger positive correlation ("Multiple Regression",

2008). The stepwise addition of Communication Arts data as an independent variable did not contribute a positive increase in the coefficient of determination (R^2) value. The amount of change in this value was .003. The stepwise addition of Combined Communication Arts and Mathematics scores also did not contribute a positive increase in the coefficient of determination (R^2) value. The amount of change in the coefficient in this case was also .003. Correlation coefficients are summarized in Table 7. Constants, B, and Beta values are summarized in Table A4.

Table 7

Correlations

		GPA	MAP CA	MAP MA	Combined CA & MA
GPA	Pearson Correlation	1	.567**	.674**	.466**
	Sig. (1-tailed)		.000	.000	.001
MAP CA	Pearson Correlation	.567**	1	.791**	.959**
	Sig. (1-tailed)	.000		.000	.000
MAP MA	Pearson Correlation	.674**	.791**	1	.949**
	Sig. (1-tailed)	.000	.000		.000
Combined CA & MA	Pearson Correlation	.466**	.959**	.949**	1
	Sig. (1-tailed)	.001	.000	.000	

Note: GPA = Grade Point Average. MAP = Missouri Assessment Program. CA = Communication Arts. MA = Mathematics. Sig. = Significance. n = 45.

** Correlation is significant at the 0.01 level (1-tailed).

Regression coefficients indicated with 98% confidence that MAP Mathematics

scores may explain 45% of the resulting Grade Point Averages in the population. The correlation value (R) of 0.674 indicated a high correlation between the two variables. Communication Arts scores may explain 32% of the variability in resulting Grade Point Averages. The correlation value (R) of 0.567 indicated a moderate (Gay & Airasian, 2003, p. 314) correlation between the two variables. As stated, the addition of Combined scores of Communication Arts and Mathematics as an independent variable did not indicate an increase in the coefficient of determination (R^2); however, the Combined scores did indicate a moderately related, positive correlation (R=.466) when considered as a single independent variable. The coefficient of determination (R^2) value of the combined scores may explain 22% of the variability in resulting Grade Point Averages.

Table 8

Correlation between MAP Communication Arts Scores and Freshman English GPA

		MAP CA	GPA
MAP CA	Pearson Correlation	1	.478**
	Sig. (2-tailed)		0.001
GPA	Pearson Correlation	.478**	1
	Sig. (2-tailed)	0.001	

Note: MAP = Missouri Assessment Program. CA = Communication Arts. GPA = Grade Point Average. Sig. = Significance. n = 44.

** Correlation is significant at the 0.01 level (2-tailed).

Though not formally addressed with questions and hypotheses, the study explored

relationships correlating MAP Communication Arts to freshman English GPA and MAP Mathematics scores to freshman mathematics GPA.

Table 8 indicates correlation coefficients in the moderately related range (Gay & Airasian, 2003, p. 314) for Communication Arts (R=0.478). A coefficient of determination (R^2) value of 0.228 indicates that 22.8% of the variability in resulting freshman-year English GPAs may be explained by the MAP Communication Arts scores.

Table 9 indicates correlation coefficients in the moderately related range (Gay & Airasian, 2003, p. 314) between MAP Mathematics and freshman-year mathematics GPA (R=.550). A coefficient of determination (R^2) value of 0.30 indicates that 30% of the variability in resulting freshman-year mathematics GPAs may be explained by the MAP mathematics scores.

Table 9

Correlation between MAP Mathematics Scores and Freshman Mathematics GPA

		MAP MA	GPA
MAP MA	Pearson Correlation	1	.550**
	Sig. (2-tailed)		0
GPA	Pearson Correlation	.550**	1
	Sig. (2-tailed)	0	

Note: MAP = Missouri Assessment Program. CA = Communication Arts.
GPA = Grade Point Average. n = 44.
** Correlation is significant at the 0.01 level (2-tailed).

Logistic Regression Analysis

Following the establishment of significant positive correlation between each of the independent variables and the dependent variable, a logistic regression analysis was applied to the data. The logistic regression analysis utilized conditional probabilities in an attempt to answer question number four by linking specific MAP category scores as predictors of specific GPA categories. Question number four asked the following: What is the value of middle school Missouri Assessment Program (MAP) scores in predicting subsequent academic performance during the first year of high school?

The logistic regression analysis indicated correlations between the independent and dependent variables that were less strong than those yielded with the multiple regression analysis. The multiple regression analysis yielded moderate, high, and moderate correlation coefficients (Gay & Airasian, 2003, p. 314) for MAP Communication Arts, MAP Mathematics, and Combined MAP Communication Arts and Mathematics scores, respectively, when related to freshman-year GPA.

At a significance level of .01, the logistic regression analysis yielded low to nonexistent, moderate, and low to nonexistent (Gay & Airasian, 2003, p. 314) coefficients for MAP Communication Arts, MAP Mathematics, and Combined MAP Communication Arts and Mathematics scores, respectively, when related to freshman-year GPA. The moderate correlation between MAP Mathematics indicated a rationale for analyzing data with the conditional probability model discussed in the previous chapter.

Values for coefficients of determination (R^2), degrees of freedom, significance, constants, and B coefficients for correlation with freshman-year GPA are summarized in Table A5 for Communication Arts; Table A6 for Mathematics; and Table A7 for

Combined Communication Arts and Mathematics. Both linear best fit and curve estimation for each independent variable, as related to freshman-year GPA, are illustrated in Figure B3 for Communication Arts; Figure B4 for Mathematics; and Figure B5 for Combined Communication Arts and Mathematics scores. Each figure indicates a positive correlation between independent and dependent variables.

Conditional Probabilities

In the multiple and logistic regression analyses, the strongest correlation to freshman-year GPA was formed with MAP Mathematics scores. A logistic model designed upon the use of conditional probabilities to analyze the strength of prediction of MAP Communication Arts, MAP Mathematics, and the Combined MAP Communication Arts and Mathematics scores also indicated that MAP Mathematics forms the strongest relationship to freshman-year GPA. MAP Mathematics was identified as a potential strong predictor of freshman-year GPA using this model. The model also indicated similar trends of strength and weakness when comparing base line year data to cross-validation year data for all three independent variables. The cross-validation process indicated that the conditional probability system yields reliable results over the two year span examined in this study.

Table 10 summarizes prediction calculations for the base line class of 2010 designed from conditional probabilities. The probabilities examined data generated by students achieving proficient and advanced categories on the MAP Communication Arts and Mathematics assessments. The Category Accuracy Rate (CAR) indicated the proportion of students who first achieved the desired MAP category and subsequently achieved the examined GPA category. A probability rate greater than .50 is considered a

Table 10

Proficient and Advanced (Score Level of 4 and above)

Base Line Year Conditional Probability Statistics (Class of 2010)

GPA Level	Base Line %	Predictor	Minimum	CAR	Δ CAR	SR
2.0		8th Grade MAP CA	4	0.95	0.11	0.63
And	84	8th Grade MAP Math	4	0.96	0.12	0.68
Above		Combined CA & Math	8	0.97	0.12	0.32
2.5		8th Grade MAP CA	4	0.90	0.18	0.72
And	72	8th Grade MAP Math	4	0.89	0.17	0.75
Above		Combined CA & Math	8	0.92	0.20	0.37
3.0		8th Grade MAP CA	4	0.77	0.21	0.79
And	56	8th Grade MAP Math	4	0.75	0.19	0.83
Above		Combined CA & Math	8	0.81	0.25	0.42
3.5		8th Grade MAP CA	4	0.53	0.18	0.86
And	35	8th Grade MAP Math	4	0.53	0.18	0.91
Above		Combined CA & Math	8	0.57	0.21	0.46
3.75		8th Grade MAP CA	4	0.68	0.48	0.93
And	20	8th Grade MAP Math	4	0.69	0.49	0.96
Above		Combined CA & Math	8	0.65	0.45	0.52

Note: GPA = Grade Point Average. CAR = Category Accuracy Rate. ΔCAR = Increase in Category Accuracy Rate. SR = Success Rate. MAP = Missouri Assessment Program. CA = Communication Arts. N = 416.

successful prediction rate (O'Halloran, 2008). All predictors yielded Category Accuracy greater than .50. A comparison to the base line percentage for each category predictor was provided as an increase in Category Accuracy Rate (ΔCAR). A larger ΔCAR indicated a stronger prediction trend. The strongest predictors indicated were Communication Arts, Mathematics and Combined scores for the GPA category of 2.0 & above; and Communication Arts for the category of 3.0 & above. Table 11 summarizes data from the class of 2011, used for cross-validation of the conditional probability prediction process.

Success Rate (SR) indicated the success of predicting the number of students who would achieve a GPA in a specific category when the successful MAP category is identified first. SR is calculated by dividing the number of students in the GPA category by the number of students expected in the category. A larger decimal indicated a stronger success rate for prediction.

Table A8 places the CAR for the base line year next to the CAR for the cross-validation year. All prediction categories, except for those in the 3.5 & above and 3.75 & above GPA categories indicated CAR values very close to each other when comparing trends from the two years to each other. Differences ranged from 0.00 to 0.03 except for the top two GPA categories, where differences ranged from 0.06 to 0.15.

Table A9 places the ΔCAR for the base line year next to the ΔCAR for the cross-validation year for comparing trends in prediction when using the conditional probabilities. This value is the increase in category accuracy rate. The strength of using conditional probabilities for predicting the number of students likely to achieve in each GPA category over using base line, historical percentages alone is indicated. Differences

Table 11

Proficient and Advanced (Score Level of 4 and above)

Cross-Validation Year Conditional Probability Statistics (Class of 2011)

GPA Level	Base Line %	Predictor	Minimum	CAR	Δ CAR	SR
2.0		8th Grade MAP CA	4	0.96	0.15	0.62
And	81	8th Grade MAP Math	4	0.96	0.15	0.69
Above		Combined CA & Math	8	0.96	0.15	0.18
2.5		8th Grade MAP CA	4	0.91	0.24	0.71
And	67	8th Grade MAP Math	4	0.86	0.19	0.75
Above		Combined CA & Math	8	0.92	0.25	0.30
3.0		8th Grade MAP CA	4	0.79	0.28	0.81
And	51	8th Grade MAP Math	4	0.74	0.23	0.85
Above		Combined CA & Math	8	0.82	0.31	0.35
3.5		8th Grade MAP CA	4	0.53	0.26	0.90
And	27	8th Grade MAP Math	4	0.58	0.31	0.88
Above		Combined CA & Math	8	0.51	0.24	0.39
3.75		8th Grade MAP CA	4	0.73	0.58	0.96
And	15	8th Grade MAP Math	4	0.76	0.61	0.94
Above		Combined CA & Math	8	0.73	0.58	0.41

Note: GPA = Grade Point Average. CAR = Category Accuracy Rate. ΔCAR = Increase in Category Accuracy Rate. SR = Success Rate. MAP = Missouri Assessment Program. CA = Communication Arts. N = 341.

Table 12

Proficient and Advanced (Score Level of 4 and above)

Comparison of Base Line Year SR to Cross-Validation Year

GPA Level	Predictor	Minimum	2010 SR	2011 SR
2.0	8th Grade MAP CA	4	0.63	0.62
And	8th Grade MAP Math	4	0.68	0.69
Above	Combined CA & Math	8	0.32	0.18
2.5	8th Grade MAP CA	4	0.72	0.71
And	8th Grade MAP Math	4	0.75	0.75
Above	Combined CA & Math	8	0.37	0.30
3.0	8th Grade MAP CA	4	0.79	0.81
And	8th Grade MAP Math	4	0.83	0.85
Above	Combined CA & Math	8	0.42	0.35
3.5	8th Grade MAP CA	4	0.86	0.90
And	8th Grade MAP Math	4	0.91	0.88
Above	Combined CA & Math	8	0.46	0.39
3.75	8th Grade MAP CA	4	0.93	0.96
And	8th Grade MAP Math	4	0.96	0.94
Above	Combined CA & Math	8	0.52	0.41

Note: SR = Success Rate. GPA = Grade Point Average. MAP = Missouri Assessment Program. CA = Communication Arts. MA = Mathematics.

ranged from 0.02 to 0.07 except for the top two categories of 3.5 & above and 3.75 & above. Those categories ranged from 0.03 to 0.13.

The Success Rate describes the relative advantage of using conditional probabilities as a predictor of the number of students likely to achieve in each individual category of cumulative GPA. Table 12 places data from the base line year next to data from the cross-validation year for examination of prediction trends from year-to-year. Differences ranged from 0.1 to 0.14.

The relationship between the base line year and cross-validation year for Success Rate is illustrated in Figure 1 for Communication Arts as a predictor; in Figure 2 for Mathematics as a predictor; and Figure B6 for Combined Communication Arts and Mathematics as a predictor.

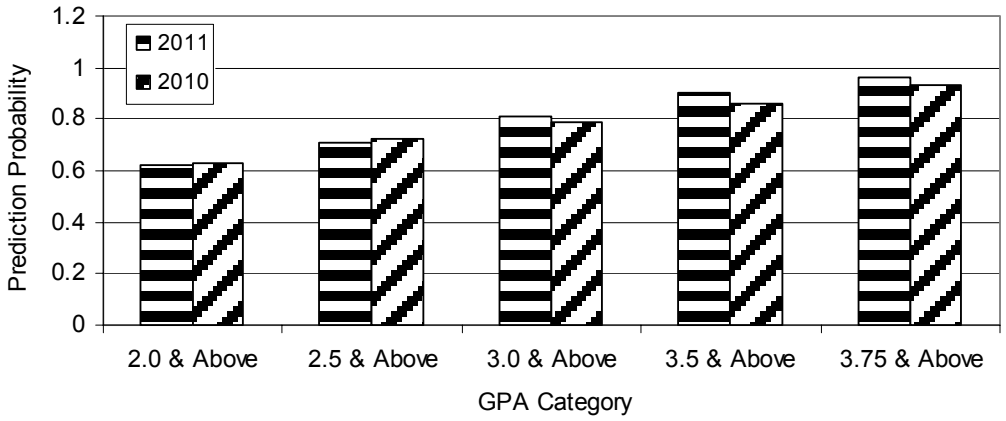

Figure 1. Comparison of Base Line Year to Cross-Validation Year: Success Rate of Prediction with MAP Communication Arts Scores

Note: CA = Communication Arts. MA = Mathematics. GPA = Grade Point Average.

p = .50 for successful probability prediction.

Figure 1 provides a visual for prediction Success Rates when using MAP Communication Arts scores as the predictor for freshman-year GPA category. The base line year and cross-validation year yielded very close Success Rates in all categories. Also, the prediction probability for Success Rate for each category, for both sets of data, was above p = .50. This is considered to indicate a successful predictor (O'Halloran, 2008).

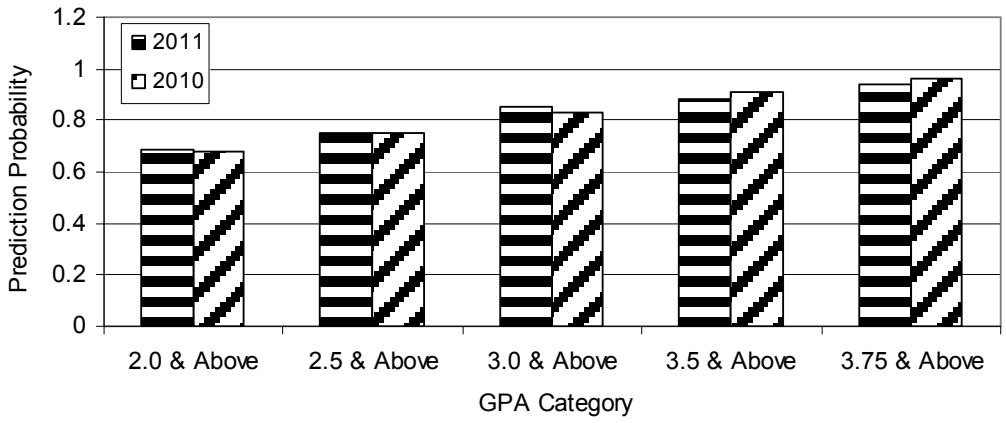

Figure 2. Comparison of Base Line Year to Cross-Validation Year: Success Rate of Prediction with MAP Mathematics Scores

Note: CA = Communication Arts. MA = Mathematics. GPA = Grade Point Average.

p = .50 for successful probability prediction.

Figure 2 illustrates the comparison of prediction probabilities for Success Rate between the base line year and cross-validation year. Success Rates for the use of MAP Mathematics scores as a predictor were higher than for the use of MAP Communication Arts as a predictor. All categories yielded values very close together when comparing the base line data to the cross-validation data. All probability values were above .50

indicating that MAP Mathematics scores are considered as successful predictors of the cumulative freshman-year GPA category.

Figure B6 illustrates the comparison between the base line year and cross-validation year of prediction probabilities for Success Rate with the use of combined Communication Arts and Mathematics scores. All categories except 3.75 & above for the class of 2010 indicated probabilities less than .50. Values below .50 indicated unsuccessful prediction of the freshman-year GPA category when using Combined MAP Communication Arts and Mathematics scores.

The multiple regression analysis and the logistic model built with conditional probabilities both indicated that Combined MAP Communication Arts and Mathematics scores was the weakest predictor of the three independent variable choices.

Deductive Conclusions

Stepwise Multiple Regression Analysis

Results of this study indicated high to moderate correlations between the independent variables of MAP Mathematics, MAP Communication Arts, and MAP combined scores and the dependent variable of freshman-year Grade Point Average. There is a pattern of predictability between each independent variable and the dependent variable. However, the correlations yielded with stepwise multiple regression analysis were high for Mathematics and moderate for Communication Arts and the Combined scores category. At the 98% confidence level, a portion of freshman-year GPAs may possibly be predicted or explained by each variable as listed: MAP Mathematics (45%), MAP Communication Arts (32%), and MAP Combined Communication Arts and Mathematics (22%). Mathematics was found to be the strongest predictor. Addition of the

Communication Arts score into calculations did not yield a stronger predictor than use of Mathematics scores alone.

Results are strong enough to indicate that the educator may choose to use MAP Mathematics scores as a portion of an evaluation of student academic strengths and weaknesses. However, the low coefficient of determination (R^2) value of .45 indicates that it should not stand alone as a sole predictor of academic success during the freshman year of high school enrollment.

Conditional Probability Model

The use of conditional probabilities built from historical data generated by a population from the district in which they will be used could possibly offer accuracy in the prediction of freshman-year GPA. Students exposed to the same curriculum, grading scales, sets of teachers, and instructional location should show similar patterns in data from year to year. This study did yield very close probability rates over the span of the two years from which data were generated and then cross-validated. However, this model also yielded only moderate relationships, with MAP Mathematics indicating the strongest predictive characteristics.

When calculating success rate in predicting GPA using MAP Mathematics, all probabilities for all GPA categories were larger than the $p = .50$ cut off point. However, they were not much higher. MAP Communications Arts yielded similar probabilities, with lower success rates. Combined MAP Communication Arts and Mathematics yielded success rates lower than the desired $p = .50$ cut off. So, once again, the educator may wish to use MAP Mathematics scores as a portion of a student's evaluation of academic strengths and weaknesses but should not use the scores as a stand-alone method for

predicting freshman-year GPA. GPA categories of interest in analyzing student strength should be 3.0 & above; 3.5 & above; and 3.75 & above when utilizing MAP Mathematics scores. Categories of interest, if choosing to use MAP Communication Arts as a predictor, should be 3.5 & above and 3.75 & above.

Students scoring in the undesirable MAP categories of Basic and Below Basic, for either the Communication Arts or Mathematics assessment, are at risk of achieving freshman-year GPAs of 2.0 & below. This indicator should be one considered by the educator evaluating student academic strengths and weaknesses. The conditional probability model was not successful in predicting the number of students likely to achieve a Grade Point Average of 2.0 & below when first given that the MAP category score was Basic or Below Basic.

The conditional probabilities model indicated that use of the knowledge of MAP category achievement yielded a more successful prediction of freshman-year GPA category than did a prediction not using MAP as a tool. If 20% of the student population scored in the 3.75 & above GPA category last year, it is not necessarily likely that 20% of the student population will score the same this year. However, the educator is given a more likely prediction when considering the scenario where 20% of the students who *first* achieved a desired MAP Mathematics category scored in the 3.75 & above GPA category last year. In this case, 20% of the students who scored in the desired category this year will also score in the 3.75 & above GPA category.

Summary

Analysis of data from this study resulted in rejection of all three null hypotheses and conclusion that the alternative hypotheses are true. The alternative hypotheses state

that there is a significant, positive correlation between the dependent variable of high school freshman-year GPA and each of the three independent variables generating data from the middle school, MAP Communication Arts, MAP Mathematics, and Combined MAP Communication Arts and Mathematics scores.

Consideration of the stepwise multiple regression analysis and the logistic model utilizing conditional probabilities when examining the relationship between MAP scores and freshman-year, high school GPA brought to light interesting trends and patterns in data that warrant further study. Though no strong, solid recommendations of educator action result from the study, there are indications that middle school MAP scores form a high enough correlation to freshman year, high school GPA that they should be considered when evaluating student strengths and weaknesses and helping the student choose a course of study.

This study established a positive correlation between middle school MAP scores and freshman-year GPA. Further analysis suggests that MAP Mathematics demonstrates a stronger relationship than MAP Communication Arts. The next chapter discusses results. Recommendations for application and further study are also discussed.

CHAPTER FIVE – DISCUSSION

This study analyzed the correlation of student middle school Missouri Assessment Program (MAP) scores in the Communication Arts and Mathematics categories to subsequent high school cumulative Grade Point Average (GPA) following the freshman year of high school. Missouri Assessment Program (MAP) scores were chosen as the independent variable because they are designed to provide a measure of appropriate content knowledge and skill strength in core academic areas. Freshman-year GPA was chosen as the dependent variable since the majority of public schools rate student academic success with this tool. The study site school district administers the MAP to all district students, so middle school MAP scores and subsequent high school GPA provided data for a thorough analysis.

To identify and meet student academic needs and to progress toward required Adequate Yearly Progress (AYP), educators need an efficient method for predicting student success at the high school level. Early prediction may impact staffing and budgeting and allow time for planning proper academic support for low achieving students. A positive correlation between the variables may indicate the strength of previous planning and alignment of district curriculum with state content standards.

This study yielded a relationship to support the use of middle school MAP scores as predictors of high school academic success. Missouri Assessment Program (MAP) information should be useful as educators plan programming to transition middle school students to high school and should provide a successful tool for evaluation of curriculum

alignment. MAP Mathematics was the independent variable providing the strongest relationship with the dependent variable of freshman-year GPA.

A highly positive correlation was found between MAP Mathematics scores and freshman-year GPA. A moderately positive correlation was found between MAP Communication Arts scores and freshman-year GPA. The mathematics category offered the strongest relationship. A Combination of Communication Arts and Mathematics scores did not offer a stronger relationship than the one discovered using Mathematics scores alone. An examination of the probability of achieving a particular GPA level when first achieving the Proficient or Advanced category on a middle school MAP exam indicated possible successful prediction of GPAs of 3.0 & above. Prediction of GPA levels of 2.0 & below was not as successful.

Implication for Effective Schools

This study did not definitively prove a strong predictive relationship between middle school MAP scores and freshman-year GPA; however, trends in data indicate that assessment scores should be considered when choosing criteria to evaluate academic strength and weakness in preparation for transition to the high school campus.

Review of literature indicated that strategies may be adopted by school districts to utilize state assessment results for programming and decision-making purposes. Though moderate, the relationships established in this study support the potential use of middle school assessment scores to guide planning related to the transition of students from the middle to the high school campus. Analysis of data can support district evaluative processes related to supporting the transition of students to the high school setting.

The establishment of a positive correlation between middle school MAP scores

and freshman-year GPA supports the consideration of assessment scores as a potential tool to guide administrative decision-making concerning major district goals. Assessment scores, used in combination with other criteria, may help districts in efforts to raise the percentage of students who persist to graduation in a timely manner, provide support for students who exhibit characteristics of academic risk or giftedness, and move the student population closer to meeting AYP, as defined by the No Child Left Behind Act.

Provision of reliable assessment data may provide an analysis that will allow districts to promote early programming and staffing of appropriate academics before students arrive on the high school campus. Data may validate and reinforce successful district K–12 vertical alignment of curriculum, as well as successful alignment of curriculum with state standards.

Recommendations

Factors to Include in Future Studies

Results of this study established a strong enough correlation between middle school assessment scores (R_{MA} = .674; R_{CA} = .567) and freshman-year GPA to motivate other individual districts to examine local data for strength of relationship. For the study site district, Mathematics assessment may explain only 45% of the variation in resulting GPAs, and Communication Arts may explain only 32% of the variation in resulting GPAs. Other districts may find that factors not reported in this study such as choice of school improvement model and type of course scheduling may be better controlled or more favorable toward supporting a stronger relationship. School improvement models used by buildings in the study site district include Professional Learning Communities

and Accelerated Schools. The study site high school implements an eight-block course schedule, as opposed to the more traditional six hour school day.

Districts should identify and study the effects of other academic measurements and population characteristics that could improve early decisions concerning programs to enhance student achievement as the transition from middle school to high school is completed. An evaluation of the strength of vertical curriculum alignment should be implemented. A reflection upon other curriculum related topics should be considered. Perhaps a study similar to this one, with data from other factors considered, could guide and improve decisions that will directly impact student achievement. A measuring tool other than grade point average could be considered as an indicator of student success.

Results from this study could possibly be strengthened through consideration of data from a wider time span. Perhaps a correlation with high school GPA measured at the end of the senior year of high school, as opposed to the end of the freshman year, would provide different, reliable results. Another possibility is the use of a combination of middle school MAP scores including other categories gathered for students' sixth, seventh, and eighth grade years, instead of mathematics and communication arts scores from the eighth grade year, as presented here.

One factor that could possibly strengthen this study is control of instructional delivery. If a district is able to minimize the number of teachers delivering district-approved curriculum to freshmen, perhaps factors caused by differences in delivery method could be eliminated or minimized in the study. This added control could possibly yield a stronger correlation between middle school MAP scores and freshman-year GPA.

A better-defined view of the usefulness of using MAP scores to guide transition decisions could then be provided.

Missouri is introducing the science category as a required MAP assessment. This requirement will increase district participation in the administration of assessment in that core area of study. The action will provide another widely-used measurement tool generating data that may be checked for its predictive value for high school GPA.

Future Consideration

Factors to be considered in future study include Missouri's plan to replace the current general science knowledge exam with end-of-course exams on the high school level. The study site district is implementing a change to use of weighted grades in calculating grade point average. The use of a weighted-grading system would influence the correlation between variables examined in this study.

Summary

Student achievement has long been the focus of public education. The requirement of meeting Adequate Yearly Progress, as mandated by No Child Left Behind requirements, has forced educators to more closely examine achievement and to devise methods to quantify student results in the area of academic skill. This study is one of many focused attempts to identify effective tools that promote efficient, positive movement along the student achievement continuum. Review of literature has convinced this researcher that each small examination of the education process either adds to or eliminates from the list of strategies available. The examination of the process, not necessarily the study result, provides the value.

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APPENDIX A

Statistical Tables

Descriptive Statistics

Table A1

Random Sample Distribution
Enrollment for Freshman English Teachers

Teacher	# students
A (English)	1
B (English)	1
C (English)	1
D (English)	1
E (English)	2
F (English)	3
G (English)	3
H (English)	5
I (English)	5
J (English)	5
K (English)	6
L (English)	10

Note: Two year time span used. n = 45.

Table A2

Random Sample Distribution
Enrollment for Freshman Mathematics Teachers

Mathematics Teacher	# students
A (Mathematics)	1
B (Mathematics)	1
C (Mathematics)	1
D (Mathematics)	2
E (Mathematics)	2
F (Mathematics)	3
G (Mathematics)	4
H (Mathematics)	5
I (Mathematics)	6
J (Mathematics)	6
K (Mathematics)	11

Note: Two year time span used. n = 45.

Table A3
Random Sample Cases: Class of 2010 & 2011 (n = 45)

Case #	Grade	Cum-GPA	CA Score	MA Score	Combined CA & MA
5	10	4	729	781	1510
7	11	4	737	771	1508
33	11	4	710	746	1456
48	10	4	712	732	1444
63	10	3.92857	734	761	1495
85	11	3.85714	750	763	1513
139	10	3.71429	721	726	1447
142	11	3.71429	703	762	1465
145	11	3.71429	707	704	1411
163	10	3.71429	736	758	1494
173	11	3.64286	682	708	1390
217	11	3.5	680	692	1372
243	11	3.42857	602	652	1254
244	11	3.42857	701	703	1404
252	11	3.42857	764	760	1524
267	11	3.38462	716	755	1471
270	10	3.35714	720	752	1472
279	11	3.35714	719	743	1462
280	10	3.35714	743	740	1483
300	10	3.28571	703	747	1450
302	11	3.28571	714	690	1404
317	10	3.28571	682	694	1376
365	10	3.14286	690	729	1419
369	10	3.14286	697	683	1380
398	11	3	741	718	1459
430	11	2.92857	683	677	1360
459	11	2.78571	735	758	1493
464	11	2.78571	711	733	1444
489	10	2.71429	663	643	1306
494	11	2.64286	681	725	1406
497	11	2.64286	730	750	1480
502	11	2.57143	704	707	1411
507	10	2.57143	530	635	1165
518	10	2.5	742	747	1489
528	10	2.5	719	719	1438
543	11	2.42857	717	712	1429
544	11	2.42857	650	664	1314
562	10	2.35714	625	645	1270
581	10	2.28571	685	714	1399
586	10	2.21429	715	722	1437
599	11	2.21429	665	694	1359
613	11	2.07143	695	691	1386
648	11	1.85714	705	713	1418
734	11	0.78571	653	660	1313
741	11	0.41667	653	681	1334

Note: GPA = Grade Point Average. CA = Communication Arts. MA = Mathematics. n = 45.

Multiple Regression Analysis

Table A4

Regression Coefficients

Multiple Regression (Stepwise)	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	Beta
(Constant)	-10.008	2.866	
MAP CA Score	0.018	0.004	0.567
(Constant)	-11.424	2.4	
MAP MA Score	0.02	0.003	0.674

Note: Dependent Variable: Cumulative GPA.

n = 45.

**p < .01.

Table A5

Model Summary and Parameter Estimates
Dependent Variable: Cumulative Grade Point Average

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.322	20.392	1	43	.000	-10.008	.018
Logistic	.175	9,120	1	43	.004	52.071	.993

Note: The independent variable is Missouri Assessment Program (MAP) Communication Arts Score.

n = 45.

**p < .01.

Linear and Logistic Regression Analysis

Table A6

Model Summary and Parameter Estimates
Dependent Variable: Cumulative Grade Point Average

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.454	35.820	1	43	.000	-11.424	.020
Logistic	.353	23.467	1	43	.000	259.667	.991

Note: The independent variable is Missouri Assessment Program (MAP) Mathematics Score.

n = 45.

**p < .01.

Table A7

Model Summary and Parameter Estimates
Dependent Variable: Cumulative Grade Point Average

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.434	32.910	1	43	.000	-12.385	.011
Logistic	.291	17.636	1	43	.000	245.613	.995

Note: The independent variable is Combined Communication Arts & Mathematics score.

n = 45.

**p < .01.

Conditional Probabilities

Table A8

Proficient and Advanced (Score Level of 4 and above)

Comparison of Base Line Year CAR to Cross-Validation Year

			2010	2011
GPA Level	Predictor	Minimum	CAR	CAR
2.0	8th Grade MAP CA	4	0.95	0.96
And	8th Grade MAP Math	4	0.96	0.96
Above	Combined CA & Math	8	0.97	0.96
2.5	8th Grade MAP CA	4	0.90	0.91
And	8th Grade MAP Math	4	0.89	0.86
Above	Combined CA & Math	8	0.92	0.92
3.0	8th Grade MAP CA	4	0.77	0.79
And	8th Grade MAP Math	4	0.75	0.74
Above	Combined CA & Math	8	0.81	0.82
3.5	8th Grade MAP CA	4	0.53	0.53
and	8th Grade MAP Math	4	0.53	0.58
Above	Combined CA & Math	8	0.57	0.51
3.75	8th Grade MAP CA	4	0.68	0.73
and	8th Grade MAP Math	4	0.69	0.76
Above	Combined CA & Math	8	0.65	0.73

Note: CAR = Category Accuracy Rate. GPA = Grade Point Average. MAP = Missouri Assessment Program. CA = Communication Arts. MA = Mathematics.

Table A9

Proficient and Advanced (Score Level of 4 and above)

Comparison of Base Line Year Δ CAR to Cross-Validation Year

			2010	2011
GPA Level	Predictor	Minimum	Δ CAR	Δ CAR
2.0	8th Grade MAP CA	4	0.11	0.15
And	8th Grade MAP Math	4	0.12	0.15
Above	Combined CA & Math	8	0.12	0.15
2.5	8th Grade MAP CA	4	0.18	0.24
And	8th Grade MAP Math	4	0.17	0.19
Above	Combined CA & Math	8	0.20	0.25
3.0	8th Grade MAP CA	4	0.21	0.28
And	8th Grade MAP Math	4	0.19	0.23
Above	Combined CA & Math	8	0.25	0.31
3.5	8th Grade MAP CA	4	0.18	0.26
And	8th Grade MAP Math	4	0.18	0.31
Above	Combined CA & Math	8	0.21	0.24
3.75	8th Grade MAP CA	4	0.48	0.58
And	8th Grade MAP Math	4	0.49	0.61
Above	Combined CA & Math	8	0.45	0.58

Note: Δ CAR = Increase in Category Accuracy Rate. GPA = Grade Point Average. MAP = Missouri Assessment Program. CA = Communication Arts. MA = Mathematics.

APPENDIX B

Statistical Figures

Descriptive Statistics

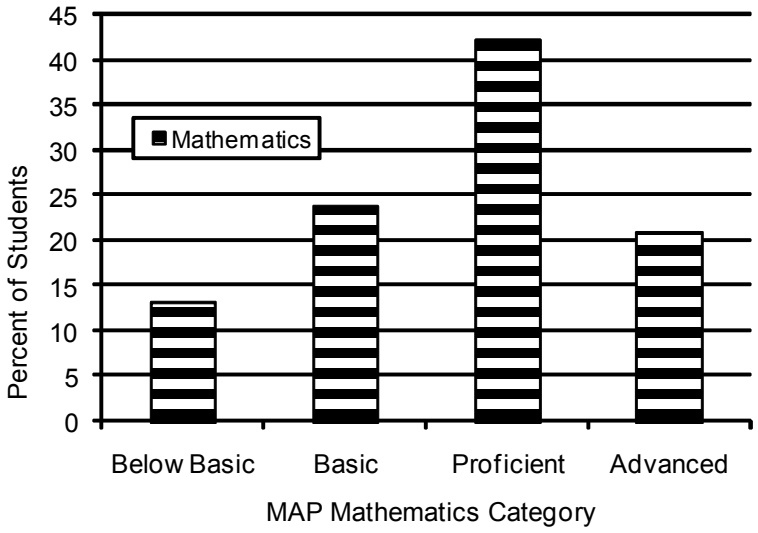

Figure B1. Study Site High School MAP Mathematics Results for Base Line Population Class of 2010

Note: Results for Base Line population as 10th graders in 2008.

From Missouri Department of Elementary and Secondary Education (2008b)

N = 514.

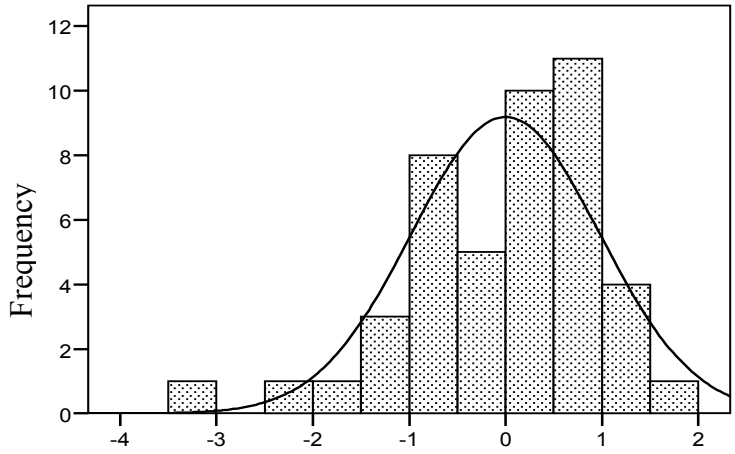

Figure B2. Frequency Distribution for 9th Grade Cumulative Grade Point Average

Note: Mean =1.65E-15. Std. Dev. = 0.977. n = 45.

Linear Best Fit and Logistic Curve Estimation

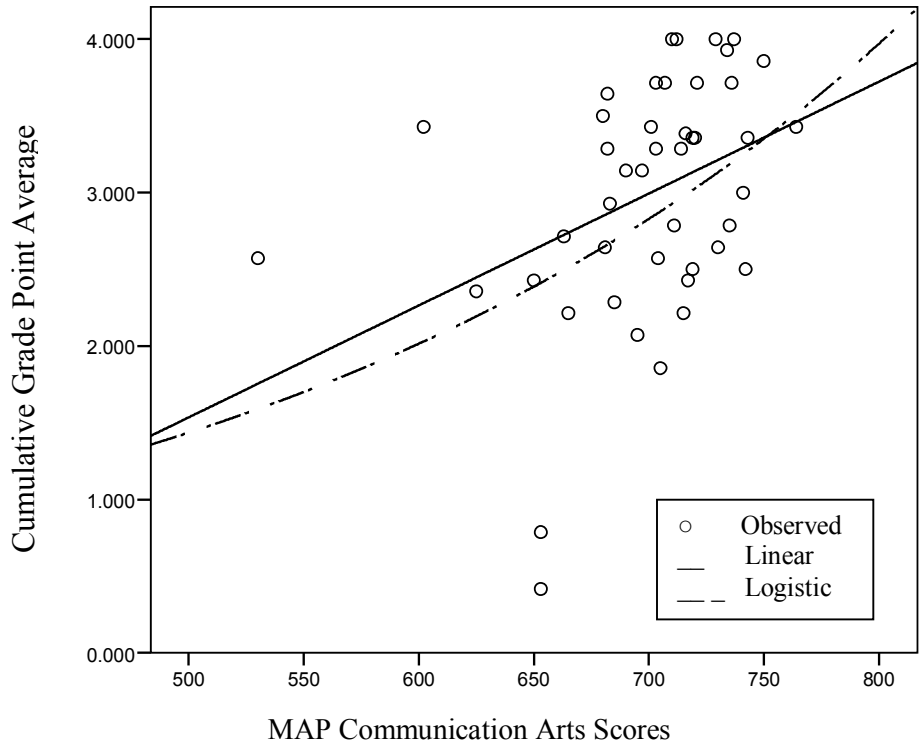

Figure B3. Linear and Logistic Regression Curves for Cumulative GPA compared to MAP Communication Arts Scores

Note: GPA = Grade Point Average. MAP = Missouri Assessment Program.

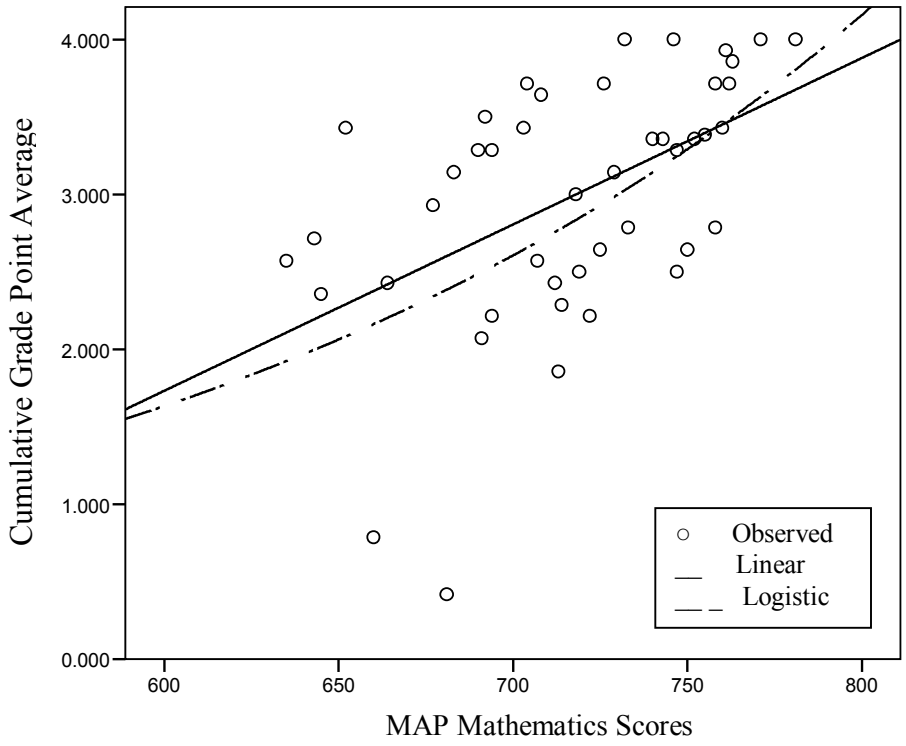

Figure B4. Linear and Logistic Regression Curves for Cumulative GPA compared to MAP Mathematics Scores

Note: GPA = Grade Point Average. MAP = Missouri Assessment Program.

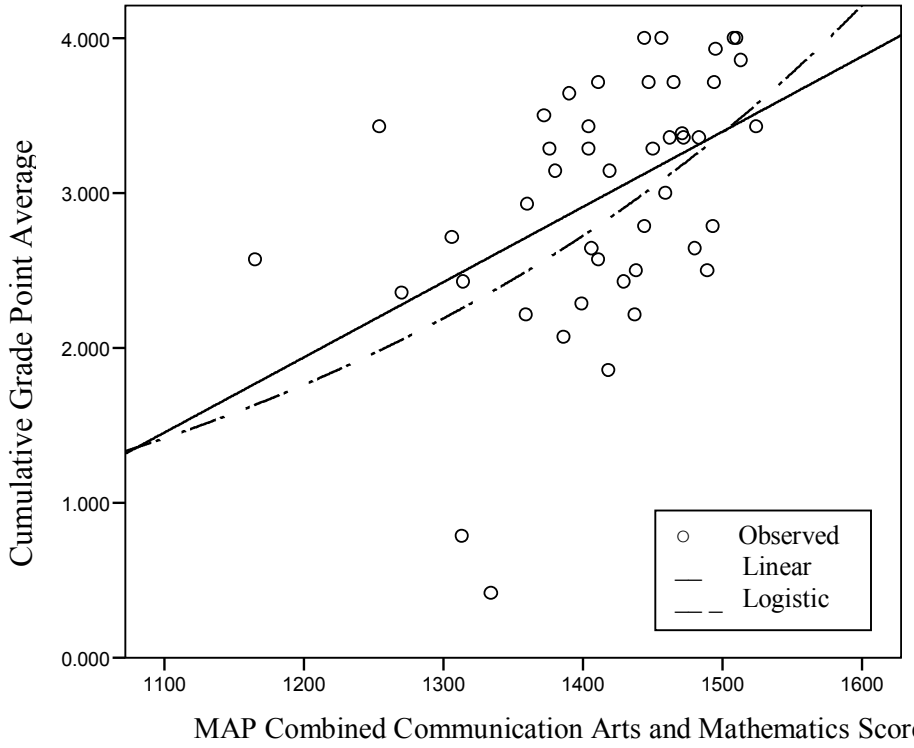

Figure B5. Linear and Logistic Regression Curves for Cumulative GPA compared to MAP Mathematics and Communication Arts Combined Scores

Note: GPA = Grade Point Average. MAP = Missouri Assessment Program.

Conditional Probabilities

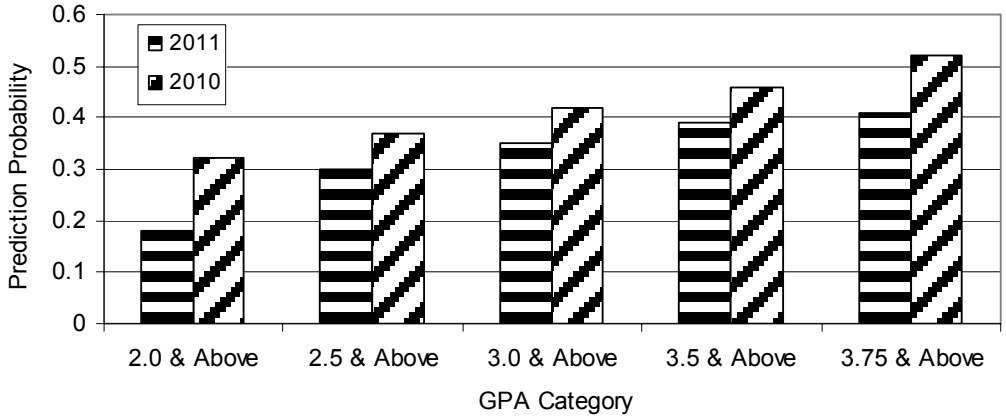

Figure B6. Comparison of Base Line Year to Cross-Validation Year: Success Rate of Prediction with MAP Combined CA and MA Scores

Note: CA = Communication Arts. MA = Mathematics. GPA = Grade Point Average.

p = .50 for successful probability prediction.

APPENDIX C

Approval Forms

IRB Project Number: 08-025

Lindenwood university
Institutional Review Board Disposition Report

To: Sherrie Wisdom
Faculty Advisor: Terry Stewart

The Institutional Review Board has reviewed the proposal for research:
Predictors of academic success for high school students.

The Institutional Review Board:
XXXX Approves the revised proposal

Tammi Pavelec 3/25/2008
Signature IRB Chair *Date*

Dr. Connie Hurst-Bayless
Assistant Superintendent for Curriculum
hurst-baylessc@mehlville.k12.mo.us

January 18, 2008

To Whom It May Concern:

Sherrie Wisdom, a Mehlville School District employee, and doctoral student at Lindenwood University, has permission to conduct a study entitled "Predictors of High School Success" using Mehlville student data. Her study will check for a relationship between middle school MAP scores and high school cumulative GPA. Universities and private high schools have formulated indicators for student success that helps them choose who to admit to their programs of study. Sherrie's study will contribute to the body of information to assist public schools to identify success markers for incoming students. Identification to support the planning process for providing proper, challenging coursework to gifted and average-level students, and to provide proper support for those with more demanding academic needs as students progress toward high school graduation is an expected outcome of this study.

Sherrie Wisdom has permission to obtain student demographic data, student GPA, and student MAP scores for Communication Arts and Mathematics for grades 6, 7, 8, 10, and 11. FERPA requirements will be followed regarding student identity with no student specific identifiable data published in the dissertation.

Upon completion, we request that Sherrie Wisdom share the results of her research with appropriate colleagues at Mehlville School District. We appreciate the intent and scope of her research.

Sincerely,

Connie M. Hurst-Bayless

Connie Hurst-Bayless, Ed.D.
Assistant Superintendent for Curriculum

314 467-5154
Fax: 314 467-5198

3120 Lemay Ferry Road
St. Louis, MO 63125-4416

PLEASE POST

Notice of Final Oral Presentation

DATE: December 18, 2008, at 5:00 p.m.
Spellman Center, Room 4105.

TO: School of Education

This is to verify that Sherrie L. Wisdom has presented her Doctor of Education Dissertation to the Doctor of Education Degree Dissertation Committee:

Dissertation Project Title:

Predictors of academic success for high school students:
The correlation between middle school Missouri Assessment Program scores and freshman year Grade Point Average.

Date of Dissertation Completion: November 14, 2008

Grade (Pass/Fail): Pass

Cynthia J. Bice Ed.D. — 12-18-08
Dr. Cynthia J. Bice, Dissertation Chair — Date

Cindy Vitale Ed.D. — 1/6/09
Dr. Cindy Vitale, Committee Member — Date

A G Streb Ed. D — 1/6/09
Dr. A. G. Streb, Committee Member — Date

Lois A. Clark, Ed.D — 12/18/08
Dr. Lois A. Clark, Committee Member — Date

Kelly E Dickinson, MA — 1/5/09
Mrs. Kelly Dickinson, MA, Committee Member — Date

VITAÉ

Sherrie L. Wisdom currently teaches physics and serves as science department chairman at Oakville High School, in the Mehlville School District, in St. Louis, Missouri. Teaching experiences have included grades 7 -12 mathematics and physics and college level education courses. Specific areas of interest are curriculum and instruction and assessment with data management.

Educational studies have resulted in an Education Specialist Degree in educational leadership from Webster University, a Master of Arts Degree in applied mathematics from the University of Missouri – St. Louis, a Master of Education Degree in curriculum and instruction from the University of Missouri – Columbia, and a Bachelor of Science in Education Degree from Truman State University.