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The Effect of Formal Pedagogical Training of Mathematics Faculty on Community College Student Success and Retention

Douglas Neal Donohue

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The effect of formal pedagogical training of mathematics faculty on community college
student success and retention

By

Douglas Neal Donohue

A Dissertation
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in Community College Leadership
in the Department of Educational Leadership

Mississippi State, Mississippi

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This study examined the correlation between the proportion of full time mathematics faculty with formal pedagogical training at eight Mississippi public community colleges named to the Aspen Foundation list of the top 150 community colleges in the United States and the proportion of developmental math students who successfully completed a college algebra course in their 1st year, the proportion of students who graduated within 4 years, and the proportion of 1st-time full-time students who returned for the 2nd year. After collecting data from 6 of the 8 colleges, a correlational analysis revealed no statistically significant relationships between the proportion of pedagogically trained math faculty and the proportion of students who successfully completed developmental math, the proportion of students who successfully graduated, or the proportion of students who were retained. There may be some relationship between the faculty preparation and student success ($p = 0.1441$).

DEDICATION

I want to dedicate this work to the most important people in my life - my wife, Monica, and my children, Michaela, Dakota, and Savannah. I appreciate your patience, understanding, encouragement, support, and steadfast love. I also want to thank my parents, John and Susan Donohue, for your love and support throughout this process. I love you all, and I am forever grateful to you.

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CHAPTER I

INTRODUCTION

The American public has lost confidence in many of the institutions that once were taken for granted. Banks, corporations, governments, and educational institutions have abused the public trust for decades, and now American citizens demand accountability. Educational institutions must demonstrate an ability to use tuition dollars and convert them into higher earnings for their graduates. Often, only the students who earn a credential from the college will realize those higher earnings.

The colleges must increase the number of students who complete the credential and graduate. Since it is less expensive to retain existing students than it is to recruit new students, the colleges need to keep their current students enrolled and progressing through the curriculum. Students must enroll in the appropriate courses, pass them successfully, and return for the following semester.

Some of the courses that cause students to stumble are referred to as “gatekeeper” classes. One of these gatekeeper courses is College Algebra. Therefore, the colleges must assign excellent teachers to the College Algebra course to increase the likelihood that students complete the course successfully and are retained in the college moving forward toward successful completion of a credential and increased earning potential.

In order for the college to assign excellent College Algebra teachers, the faculty must be well trained. The only requirement for becoming a collegiate mathematics instructor is an earned Master's degree and 18 semester hours of graduate level mathematics credit. Collegiate mathematics instructors are not required to have any formal training in the art and science of teaching and learning, pedagogy.

Teachers at the elementary and secondary levels are required to have formal training in pedagogy in order to qualify for a license to teach from the state. Since many collegiate mathematics instructors were formerly employed as teachers in secondary schools, there are many collegiate mathematics instructors who have formal pedagogical training.

The study attempted to determine if the colleges that have a higher proportion of mathematics faculty with formal pedagogical training have a higher rate of student success and a higher rate of student retention than those colleges that have a lower proportion of mathematics faculty with formal pedagogical training.

Statement of the Problem

The problem of this study was the extent to which there is a relationship between the academic performance of community college students and the formal pedagogical training of the mathematics faculty.

Purpose of the Study

The purpose of this study was to uncover any relationship between the academic success of community college students and the formal pedagogical training of the mathematics faculty by examining the statistical correlation between the proportion of

students at a college who graduate within four years and the proportion of mathematics faculty at the college who have formal pedagogical training. Additionally, this study examined the statistical correlation between the proportion of students at a college who return for a second year and the proportion of mathematics faculty at the college who have formal pedagogical training. Finally, the study examined the statistical correlation between the proportion of developmental math students who also complete College Algebra within the first year and the proportion of mathematics faculty at the college who have formal pedagogical training. Pearson Coefficients of Correlation (Pearson r) were calculated on the basis of the proportions from eight rural community colleges in Mississippi who were named as 2017 Aspen Prize eligible schools.

Research Questions

1. Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of developmental mathematics students who successfully complete College Algebra in the first year? The first question addressed the effect of pedagogically trained instructors on the success of developmental mathematics students.
2. Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of students who complete graduation requirements within four years? The second question addressed the effect of pedagogically trained instructors on student success through the completion of a credential.
3. Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of first time full

time students who return for a second year? The third question addressed the effect of pedagogically trained instructors on student retention.

Design of the Study

The researcher calculated Developmental Success as the proportion of students from each college who were enrolled in a developmental math course during the first year and have subsequently successfully completed College Algebra by dividing the “Students (from row above) who successfully completed College Algebra” by “Headcount of students in developmental Math courses during the first academic year” under the heading of “All Student Enrollment in 1 or More Developmental Courses” found under the heading of “College Readiness Success” on page 3 of the 2014 Report Card (Report Card 2014 – Copiah Lincoln Community College, n.d.).

The researcher calculated Student Success as the proportion of students from each college who completed graduation requirements within 4 years by adding the proportion of total students who graduated in 100%, 150%, and 200% under the heading of “Student Success” on page 1 of the 2014 Report Card (Report Card 2014 – Copiah Lincoln Community College, n.d.).

The researcher recorded Student Retention as the proportion of total first time, full time students from each college who returned for a second year found under the heading “Student Retention” on page 1 of the 2014 Report Card (Report Card 2014 – Copiah Lincoln Community College, n.d.).

The researcher collected student demographic data about each of the eight colleges from The Integrated Postsecondary Education Data System (IPEDS) of the National Center for Education Statistics (nces.ed.gov/ipeds/) regarding the proportion of

students who identify themselves as non-white (Race), proportion of students receiving federal Pell grants (Socioeconomic status), and proportion of students of female gender (Gender).

The researcher collected additional student demographic data about each of the eight colleges from the Division of Research and Effectiveness of the Mississippi Community College Board regarding the mean student age (Age) and the mean student ACT score (Score).

The researcher made a formal request for information from the institutional research departments at each of the eight colleges to learn the proportion of full time mathematics faculty members who have formal pedagogical training through a Bachelor's degree in Education or a Master's degree in Education (Pedagogy).

The researcher calculated a Pearson's r to obtain a measure of the correlation of Pedagogy with Developmental Success.

The researcher calculated a Pearson's r to obtain a measure of the correlation of Pedagogy with Student Success.

The researcher calculated a Pearson's r to obtain a measure of the correlation of Pedagogy with Student Retention.

The researcher calculated the Pearson's r to obtain a measure of the correlation of the other five independent variables with Developmental Success.

The researcher calculated the Pearson's r to obtain a measure of the correlation of the other five independent variables with Student Success.

The researcher calculated the Pearson's r to obtain a measure of the correlation of the other five independent variables with Student Retention.

Delimitations

The colleges that were examined in the study are the eight community colleges in the state of Mississippi who have been named by the Aspen Foundation to the list of top 150 eligible colleges to compete for their 2017 Aspen prize. Those colleges are Copiah-Lincoln Community College, East Mississippi Community College, Hinds Community College, Holmes Community College, Itawamba Community College, Meridian Community College, Mississippi Gulf Coast Community College, and Northeast Mississippi Community College.

The time period that was examined for developmental success, student success, and student retention will be the 2012 – 2013 school year as reported on the 2014 Report Card, the most recently reported information on the college.

The time period that was examined for the proportion of mathematics faculty with formal pedagogical training was the 2016 fall semester.

The proportion of mathematics faculty with formal pedagogical training only included those members of the college faculty who are full time instructors of mathematics courses.

Limitations

All of the colleges in the study are located in the state of Mississippi. While there does not seem to be evidence that community college students in Mississippi perform significantly differently than community college students in other states, the results of the study could possibly be specific to Mississippi community colleges. In addition, all of the institutions in the study have been named to the prestigious list of Aspen prize eligible colleges. This means that they rank in top 150 colleges in the United States in

characteristics related to student success. It is therefore a possibility that the results of the study may be specific to higher performing community colleges.

Significance of the Study

The results of this study could dramatically affect the hiring practices of new faculty at the community college level. The study may also shape the types of training and professional development that community colleges provide to their instructors.

Operational Definition of Terms

Formal pedagogical training is defined as having earned a Bachelor's degree in Education or a Master's degree in Education since those programs require courses in teaching methodology, special education and differentiation, educational technology, classroom management, reading and writing across the curriculum, and tests and measurements.

Developmental success is defined as having completed a College Algebra course within the first year of college with an A, B, or C after completing a developmental math course.

Student success is defined as having earned a credential from a community college within 200% of the expected time to graduation.

Student retention is defined as remaining enrolled in college from one fall semester until the next fall semester.

Student age is the mean age of the student body at a community college.

Student race is defined as the proportion of non-white, minority students enrolled at a community college.

Student socioeconomic status is defined as the proportion of the student body that receives federal Pell Grant funds.

Student gender is defined as the proportion of female students at the college.

Student ACT is defined as the mean ACT score of the student body at a community college.

Method

The study attempted to uncover any significant correlation between the proportions of students who achieve certain measurements of success and the proportion of mathematics faculty with formal pedagogical training through linear correlational analysis. It also used linear correlation analysis to identify any correlation between measurements of student success and retention with mathematics faculty with the mean student age at the college, the proportion of students of female gender, the proportion of students of lower socioeconomic status, the mean student score on college entrance exams, and the proportion of minority students at the college. The study examined eight of the top community colleges in Mississippi to answer three research questions regarding the effect of the proportion of mathematics faculty with formal pedagogical training on the success of students at the college regarding the completion of developmental mathematics and college algebra within the first year, graduation within four years, and retention from the first year to the second year.

CHAPTER II

REVIEW OF LITERATURE

Overview

The predominant literature regarding the community college students seem to focus on two desirable outcomes, student success in the classroom and student retention from year to year. If college faculty and administrators can improve the likelihood that a student will succeed and will stay in school long enough to complete the requirements for a credential, then the mission of the college will be advanced. In addition to the personal fulfillment experienced by the student, the economic benefit to the local community will be realized and the social and cultural capital of the community will increase. The community college will improve the life of the community. The analysis of factors that can improve the lives of the members of the community tend to begin with the demographic factors, but researchers always have another specific factor of interest that they include in the study. This study includes the formal pedagogical training of the faculty as a special factor.

Independent Variables

Reyes (2010) sought to determine if the length of time that a college algebra class lasted was indicative of student success in the class. She also investigated the success rates of different ethnic groups, different gender groups, and different age groups in the different length college algebra classes. Reyes retrospectively examined a sample of 415

students who were enrolled in either 8-week long or 16-week long college algebra courses at a 2-year metropolitan community college in Texas. Reyes found no statistically significant overall difference between the success of students enrolled in the shorter course and students enrolled in the longer course. However, within the Asian/Pacific Islander ethnic group there was a significant improvement in the longer class. Gender differences did not uncover any significant results, but the 23 – 30-year-old age group performed significantly better in the shorter class than the longer class. Reyes concluded that the length of the college algebra course is not the most important factor in determining student success.

Wolfe and Williams (2014) explored the effects of developmental status, age, gender, race and ethnicity on the fall-to-fall persistence and success in the first college level mathematics course. They retrospectively studied a group of 17,335 students from the 2006 cohort of first time college students in the Virginia Community College System to determine the extent that developmental status, age, gender, and race and ethnicity account for the success and for the persistence of Virginia community college students in their first year mathematics course. They also examined whether gender, age, or race and ethnicity moderated the effect of developmental status on persistence or success. They created two logistic regression models. The first model predicted success using age, gender, black, other ethnicity, developmental status, and the four interaction variables to predict success. The second model used the same nine variables to predict persistence. They found that less than 4% of the variation in the success model can be explained by the variables and less than 2% of the variation in the persistence model can be explained by the variables. They also concluded that the success and persistence of developmental

students were not dependent on gender or race and ethnicity. However, age does improve the effects of developmental status on student success.

Sandoval-Lucero, Maes, and Klingsmith (2014) interviewed 22 African American and latina/o community college graduates at an urban community college in the southwestern United States. The focus of the interviews was to identify factors that contributed to the success of community college students. This qualitative study identified three major factors that contributed to the success of these students: relationships with faculty, family support, and campus engagement and support. The researchers concluded that students choose to attend community colleges “due to proximity, accessibility, and affordability.” (p.531) They also found that ethnically diverse families support their children’s educational aspirations and that family engagement strengthens students as they navigate college. They found that religion and spirituality are also a source of motivation for college students. The interviews uncovered the same grit and perseverance in these minority community college graduates that is often seen in students at elite institutions of higher learning. The researchers recommend further investigation into the personal and academic results of cultural capital regarding the success of underrepresented students in higher education.

Adams and Mix (2014) discuss the role of critical friendship groups as places where faculty members can “do the hard work of excavating previously unexamined assumptions about philosophy, pedagogy, and epistemology.” (p. 45) These determine instructional design and pedagogical decisions either consciously or unconsciously. The authors laud the presence of education faculty as members of these critical friendship groups. Their expertise in the field of teaching and learning can offer leadership and

support to the critical friendship groups and advance their goal of improving student learning at the college.

Fike and Fike (2007) examined the relationship between the employment status of the faculty and the success of college students in developmental mathematics courses. The retrospective study was motivated by the need to improve student outcomes in developmental classes and the preponderance of developmental students who require remediation in mathematics. The population consisted of students at an urban community college in Texas with an enrollment of approximately 10,000 students. The sample consisted of 1318 students enrolled in Intermediate Algebra classes in the fall semester of 2004 and the spring semester of 2005. Student outcomes were the final grades in the class and the completion status. The independent variables included faculty education level, faculty employment status, faculty race, faculty gender, student age, student race, student gender, number of students per section, and semester hours enrolled. Statistical methods included descriptive statistics of each variable, paired *t* tests, hierarchical multiple regression, and logistic regression modeling. The researchers concluded that the faculty employment status is not a factor in student success in developmental mathematics classes, but faculty education level is associated with improved student outcomes. They also found that student age, student race, and student gender were also significantly associated with final grades. It is important to note that this study is limited to students enrolled in developmental mathematics classes and the results should not be generalized to include college level classes.

Dependent Variables

Jenkins (2015) outlines three points supported by the Community College Research Center at Columbia University regarding methods that community colleges may use to improve the completion rates of their students while continuing to offer low costs and open access to students. This summary article states that the methods used by community colleges to reduce costs in the face of shrinking budgets are unlikely to improve student learning outcomes. An increased reliance on part time instructors and increased student teacher ratios has been shown to reduce completion rates. An increase in online course offerings is associated with a decreased likelihood of students to complete degrees. A second point is that small reforms are ineffective in bringing about substantial change. Colleges will need to redesign programs and support services to effect marked improvement in student success. Finally, Jenkins (2015) states that research has repeatedly shown that investment in community college education yields a high rate of return for the student and the community at large.

De Paola, Ponzio, and Scoppa (2013) analyzed the effects of class size on the achievement of college students. They analyzed data on 1088 freshmen enrolled at the University of Calabria in southern Italy in 2008. These students in the economics program and the pharmacy and nutrition program were randomly assigned to mathematics classes of differing sizes and to language skills classes of differing sizes. The faculty were also randomly assigned to these classes in this experimental design study. The students were administered an entry test. Other independent variables examined included gender, high school type, high school grades, years since high school, type of faculty credentials, class size, hours attended, peer ability, and the teachers

gender, age, and rank. The dependent variable was the students score on the exit exam. The research found a statistically significant correlation between class size and achievement in mathematics, but not in language skills. The effect of the correlation was even more profound for students of low ability. As a result of the study, the researchers encourage colleges to offer smaller math classes as a whole and especially small classes for students with low ability in mathematics.

Cortes-Suarez and Sandiford (2008) sought to establish a relationship between the way that students explain their performance, known as attribution theory, and their academic achievement. The researchers hypothesized that students who pass a college algebra test will attribute their performance to internal, stable causes that are within their personal control and which others do not control. They used an experimental design to study a sample of 410 students enrolled in MAC 1105, a 3-credit-hour mathematics course at Miami Dade College during the spring 2004 term. The researchers administered the Causal Dimension Scale II (CDSII) to students and asked them to respond to their performance on a college algebra test. This survey instrument measured four dimensions of attribution. The researchers found a statistically significant difference between the type of attributions given by students in the passing group and students in the failing group. However, the mean CDSII scores for both the passing and failing groups suggest that both groups of students attribute their performance in mathematics to something outside of themselves rather than seeing themselves as the cause for their success or failure. The researchers stated that “students in high-risk courses such as college algebra at a community college may not have the academic self-confidence to

think of themselves as successful even when they are passing the course.” (Cortes-Suarez, 2008, p. 342)

Fike and Fike (2008) conducted a quantitative, retrospective study to identify important predictors of student retention. The population under observation was 9,200 first time in college students in a west Texas community college who first matriculated in 2001, 2002, 2003, and 2004. The independent predictor variables included gender; age; ethnicity; completion of developmental math, reading, and writing; participation in student support services; receipt of financial aid; enrollment in online courses; semester hours enrolled; semester hours dropped; and parent’s education level. The dependent outcome variable is student retention. The researchers used multivariate logistic regression models to predict the likelihood of student retention. They found that gender, age, ethnicity, enrollment in developmental writing, and completion of developmental writing were not statistically significant. Factors that are positive predictors of retention include passing developmental reading, taking online courses, not taking developmental reading, participating in student services, passing developmental writing, passing developmental math, receiving financial aid, father with some college, mother with some college, and the number of semester hours enrolled. The conclusion of the researchers was that passing developmental reading, writing, and math courses makes a tremendous impact on the retention of students.

Windham (2014) conducted a post facto quasi-experimental study to establish the effectiveness of a study skills course in improving the student retention at community colleges. Factors often included in discussions of retention and student success include ethnicity, socioeconomic status, gender, age, and college readiness were included in this

study. Also included as an independent variable was participation in a college study skills class. The sample of students was taken from a southeastern community college with three campuses and five centers over a four-county district. The students enrolled as first-time, full-time freshmen in 2008, 2009, and 2010 fall semesters, and all students used an ACT COMPASS entrance exam score because they did not have an ACT score. The study included 1740 students. Logistic regression was performed to identify the predictive abilities of each of the variables. The researchers found that socioeconomic status and ethnicity/race were not significant predictors of retention. Gender, age, ACT COMPASS Reading score, and participation in the study skills class were all significant predictors of fall-to-fall retention. The researchers concluded that student success courses improve student retention and that colleges should invest resources in helping males and older students to engage on campus to improve their likelihood of being retained and completing.

Pruett and Absher (2015) retrospectively studied preexisting data from the Community College Survey of Student Engagement (CCSSE) to determine which factors played an important role in the retention of developmental education students in a 2013 cohort of community college students. The sample of developmental students from the CCSSE included 23,665 students. The dependent variable was a dichotomous retained or not retained. A Binary Logistic Regression was the statistical strategy to determine if the 10 independent variables were influential in predicting retention. The 10 factors included tutor, academic advisement, parent's education, funding, GPA, time spent in college activities, time spent in class preparation, number of remedial courses, whether student has taken developmental math, whether student has taken developmental writing, whether

student has taken developmental reading, and extent of academic engagement. The factors that were shown to be significant were academic engagement, type of developmental course, time spent preparing for class, time spent in college activities, type of funding source, GPA, and parent's education level. After GPA, the second most important factor to retention is academic engagement.

Studies That Relate Dependent and Independent Variables

Jensen (2011) performed an analysis of the current research, which highlights the importance of pedagogical training among higher education faculty. Faculty members at institutions of higher education are not held to the same standards of pedagogical preparation as teachers in K-12. The research summary points out the importance of pedagogical training. Jensen also seeks to offer suggestions on improving college-teaching practices and to encourage faculty at institutions of higher education to become better instructors through professional development in pedagogy.

Robinson and Hope (2013) surveyed professors in the State University System of Florida to assess the perceived need for graduate programs to include courses designed to prepare students to teach at the postsecondary level. The researchers solicited survey responses to The National Faculty on the Need to Prepare Graduate Students to Teach in College and University Settings instrument from full and part time faculty members employed by a four-year college or university in the State University System of Florida. 200 responses were returned and the mean score was higher than the midpoint of the total possible scores. The researchers concluded that there is a need for training in pedagogy for those who teach in higher education.

Edwards, Sandoval, and McNamara (2015) have redesigned the professional development for college faculty involved in the Community College Pathways initiative. This initiative, launched in 2009, seeks to address the problem of developmental mathematics students failing to complete any college level mathematics course within three years. A cornerstone of the Pathways initiative is the Pathways Faculty Support Program. This professional development attempts to help faculty “develop knowledge, beliefs, skills, and practices for teaching Pathways courses.” A redesign of the Faculty Support Program began in the fall of 2014 using improvement science methods to create a better program for professional development and implement a system of continuous process improvement. The authors conclude that a professional development system for community college developmental mathematics faculty should be “effective, efficient, responsive, centered on community, as well as faculty-centered and faculty-owned.” It should include high quality content on learning goals, mathematics, and pedagogy. It should also focus on faculty engagement and access.

Summary

The literature regarding student success and retention in the community colleges tends to include many of the same set of variables. Demographic independent variables like the age of the students, the gender of the students, the socioeconomic status of the students, the prior preparation of the students, and the ethnicity of the students appear over and over in the literature. The outcome variables of student success and student retention also appear frequently in the literature. Many researchers are interested in an additional unique independent variable that may influence or predict the desired outcome. The entire community of educational research seems to focus on improving the learning

outcomes as demonstrated through student success in the classroom and the retention of students from year to year until they complete the credential. This research focus is extremely important since it defines the mission of higher education. The current study will also examine a unique variable, the impact of formal pedagogical training of faculty, as it affects the desired outcomes of student success and student retention in community colleges.

CHAPTER III

METHOD OF THE STUDY

Overview of Chapter Organization

The study explored the relationship between institutions that enjoy a greater amount of student success and those institutions with a greater amount of pedagogically trained faculty. It attempted to uncover any significant correlation between the proportions of students who achieve certain measurements of success and the proportion of mathematics faculty with formal pedagogical training. The study also attempted to identify the amount of variation in institutional student success measurements attributable to the proportion of mathematics faculty with formal pedagogical training, the mean student age at the institution, the proportion of students of female gender, the proportion of students of lower socioeconomic status, the mean student score on college entrance exams, and the proportion of minority students at the institution. The study attempted to answer three specific research questions regarding the effect of the proportion of faculty with formal pedagogical training on the success of students at the institutions. In an attempt to reduce variation, the study focused on only eight of the top 150 community colleges in the United States as chosen by the Aspen Foundation for the 2017 prize. This study examined a population of the eight 2-year colleges in Mississippi named to that list. While most of the data from those eight colleges are readily available in publicly

available format, the proportion of mathematics faculty with formal pedagogical training needed to be collected from each of the eight institutions.

Description of Research Design and General Method

This study employed a quantitative, cross-sectional correlational research design with six independent variables and three dependent variables. The independent variables included the proportion of full time mathematics instructors at the institution with formal pedagogical training, the mean age of students at the institution, the mean composite ACT score of students at the institution, the proportion of minority students at the institution, the proportion of students at the institution receiving federal Pell Grants, and the proportion of female students at the institution. The dependent variables included the proportion of developmental math students at the institution who successfully completed College Algebra in the first year (Developmental Success), the proportion of students at the institution who completed graduation requirements within four years (Student Success), and the proportion of first time full time students at the institution who returned for a second year (Student Retention). The main purpose of the study was to investigate how the proportion of full time mathematics instructors at the institution with formal pedagogical training is related to the proportion of developmental math students at the college who successfully complete College Algebra in the first year, the proportion of students at the college who graduate within four years of enrollment, and the proportion of students at the college who return the next year.

Research Questions

1. Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of developmental mathematics students who successfully complete College Algebra in the first year?
2. Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of students who complete graduation requirements within four years?
3. Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of first time full time students who return for a second year?

Research Context or Site

The study collected data from the eight public community colleges located in the state of Mississippi that were named to the 2017 list of the 150 community colleges eligible for the Aspen Prize for Community College Excellence. Each of these eight public 2-year colleges is an autonomous institution governed by a local board of directors. The Mississippi Community College Board is a coordinating board for the 15 autonomous public two-year colleges located in the state of Mississippi.

Subjects or Participants

The study used institutional level data regarding age, race, gender, academic preparation, socioeconomic status, and the proportion of full time mathematics faculty

with formal pedagogical training. Therefore, no individual identifying information was collected.

The study examined a population of the eight public community colleges located in the state of Mississippi that were named to the 2017 list of the 150 community colleges eligible for the Aspen Prize for Community College Excellence.

In a comprehensive review of the publicly available data, these 150 two-year institutions—from 35 states—have demonstrated strong outcomes considering three areas of student success:

- student success in persistence, completion, and transfer;
- consistent improvement in outcomes over time; and
- equity in outcomes for students of all racial/ethnic and socioeconomic backgrounds. (College Excellence Program, 2016, p.1)

The eight public 2-year colleges from the state of Mississippi that were named to the 2017 list of colleges eligible for the Aspen Prize are:

- Copiah-Lincoln Community College, Wesson, MS
- East Mississippi Community College, Scooba, MS
- Hinds Community College, Raymond, MS
- Holmes Community College, Goodman, MS
- Itawamba Community College, Fulton, MS
- Meridian Community College, Meridian, MS
- Mississippi Gulf Coast Community College, Perkinston, MS

- Northeast Mississippi Community College, Booneville, MS

Instruments and Materials Used

The cross-sectional study used institutional data, much of which was found in the annual Community College Report Card. This annual publication is made available by each college as part of transparency measures in accordance with House Bill No. 1071 from the 2010 Mississippi legislative session.

The Community College Report Card is designed to reflect the unique missions of the community colleges. The measures that are used align closely with the Voluntary Framework of Accountability developed by the American Association of Community Colleges. Each report card includes information for the specific college, along with figures for the system (includes all 15 state community colleges).

Information contained in the report includes student enrollment, degrees awarded, student success, student retention, student progress, workforce development information, GED and adult basic education statistics, as well as enrollment and success in development or remedial coursework (college readiness). (Mississippi Gulf Coast Community College Releases Institutional Report Cards, 2013, p.1)

Data Collection Procedures

Most of the data used in the study were found on the Community College Report Card and in the National Center for Education Statistics' Integrated Postsecondary Educational Data System. The Mississippi Community College Board's Division of

Research and Effectiveness provided additional data. The remaining information was obtained through communication between the researcher and the institutional research offices at each of the eight colleges involved in the study. The researcher asked each institutional research office to provide the total number of full time mathematics faculty members at the college and the total number of full time mathematics faculty members at the college who have earned either a Bachelor's degree in Education or a Master's degree in Education.

Data Analysis Procedure

Research Question 1: Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of developmental mathematics students who successfully complete College Algebra in the first year?

This question was addressed through a correlational analysis to examine the relationship between the independent variable (Pedagogy) and the dependent variable (Developmental Success).

Additional correlational analyses were performed to examine any relationships between the other five independent variables and the dependent variable (Developmental Success).

Research Question 2: Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of students who complete graduation requirements within four years?

This question was addressed through a correlational analysis to examine the relationship between the independent variable (Pedagogy) and the dependent variable (Student Success).

Additional correlational analyses were performed to examine any relationships between the other five independent variables and the dependent variable (Student Success).

Research Question 3: Do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of first time full time students who return for a second year?

This question was addressed through a correlational analysis to examine the relationship between the independent variable (Pedagogy) and the dependent variable (Student Retention).

Additional correlational analyses were performed to examine any relationships between the other five independent variables and the dependent variable (Student Retention).

Summary of Method

The study uncovered any significant correlations between the proportions of students who achieve certain measurements of success and the proportion of mathematics faculty with formal pedagogical training through correlational analysis. It also used correlational analysis procedures to identify any significant correlations between the measures of college student success and the additional independent variables including the mean student age at the institution, the proportion of students of female gender, the

proportion of students of lower socioeconomic status, the mean student score on college entrance exams, and the proportion of minority students at the institution. The study examined eight of the top community colleges in Mississippi to answer three research questions regarding the effect of the proportion of mathematics faculty with formal pedagogical training on the success of students at the institutions regarding the completion of developmental mathematics and college algebra within the first year, graduation within four years, and retention from the first year to the second year.

CHAPTER IV
RESULTS OF THE STUDY

Population of the Study

The population examined by the study included the eight public community colleges in the state of Mississippi who have been named by the Aspen Foundation to the list of the top 150 colleges in the United States that are eligible to compete for the 2017 Aspen prize.

Table 1 illustrates that six of the eight colleges responded affirmatively to requests for information. This represents a 75% response rate. One of the colleges responded negatively to requests for information, and one of the colleges failed to respond at all to requests for information.

Table 1

Community Colleges Studied

COMMUNITY COLLEGES	LOCATION	PARTICIPATION
Copiah-Lincoln	Wesson, MS	YES
East Mississippi	Scooba, MS	DID NOT RESPOND
Hinds	Raymond, MS	YES
Holmes	Goodman, MS	YES
Itawamba	Fulton, MS	YES
Meridian	Meridian, MS	YES
Mississippi Gulf Coast	Perkinston, MS	DID NOT PARTICIPATE
Northeast Mississippi	Booneville, MS	YES

Independent Variables

The independent variables were gathered from three sources.

The National Center for Educational Statistics manages the IPEDS. Table 2 shows that the independent variables Gender, SES, and Race were obtained from IPEDS. The Gender variable represents the proportion of female students, The SES variable represents the proportion of students who received federal Pell grants, and the Race variable represents the proportion of students who identified themselves as non-white.

Table 2

Data Collected from IPEDS

COLLEGES	IPEDS ID	RACE	SES	GENDER
Copiah-Lincoln	175573	.46	.57	.61
Hinds	175786	.60	.84	.61
Holmes	175810	.52	.54	.65
Itawamba	175829	.29	.51	.60
Meridian	175935	.53	.47	.68
Northeast Mississippi	176169	.22	.60	.57

Table 3 lists the independent variables Age and Score that were obtained from the Division of Research and Effectiveness of the Mississippi Community College Board (MCCB). The Age variable represents the mean age of students, and the Score variable represents the mean ACT score of students.

Table 3

Data Collected from MCCB

COLLEGES	AGE	SCORE
Copiah-Lincoln	22.0	18.7
Hinds	24.3	18.6
Holmes	23.6	19.2
Itawamba	22.2	19.5
Meridian	24.8	18.9
Northeast Mississippi	21.3	19.7

Table 4 shows the independent variable Pedagogy that was obtained from the institutional research departments at the colleges. The Pedagogy variable represents the proportion of full time mathematics faculty with formal pedagogical training.

Table 4

Data Collected from Aspen Colleges in Mississippi

COLLEGES	PEDAGOGY
Copiah-Lincoln	.75
Hinds	.50
Holmes	.33
Itawamba	.58
Meridian	.67
Northeast Mississippi	.38

Dependent Variables

The dependent variables Developmental Success, Student Success, and Student Retention were derived from the 2014 Community College Report Card.

Table 5 shows the dependent variable Developmental Success. It represents the proportion of students who were enrolled in a developmental math course during the first year and have subsequently successfully completed College Algebra.

Table 5

Developmental Success from 2014 Report Card

COLLEGES	DEVELOPMENTAL SUCCESS
Copiah-Lincoln	.40
Hinds	.20
Holmes	.31
Itawamba	.29
Meridian	.17
Northeast Mississippi	.22

Table 6 gives the dependent variable Student Success, which represents the proportion of students who have completed graduation requirements within four years.

Table 6

Student Success from 2014 Report Card

COLLEGES	STUDENT SUCCESS
Copiah-Lincoln	.34
Hinds	.26
Holmes	.24
Itawamba	.34
Meridian	.27
Northeast Mississippi	.28

Table 7 shows the dependent variable Student Retention. It represents the proportion of first time, full time students who return for a second year.

Table 7

Student Retention from 2014 Report Card

COLLEGES	STUDENT RETENTION
Copiah-Lincoln	.62
Hinds	.53
Holmes	.52
Itawamba	.68
Meridian	.55
Northeast Mississippi	.66

Research Questions

The study addressed the three core questions.

The first question is “do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of developmental mathematics students who successfully complete College Algebra in the first year?”

The researcher performed a linear correlational analysis between the independent variable Pedagogy and the dependent variable Developmental Success and calculated a Pearson’s $r = .2495$ ($p = .6335$).

The researcher also performed a linear correlational analysis between each of the other independent variables and the dependent variable Developmental Success and calculated Pearson's r and p-values for each of them. Results are given in Table 8 below.

Table 8

Linear Correlation with Developmental Success

INDEPENDENT VARIABLE	PEARSON CORRELATION COEFFICIENT (r)	P-VALUE
PEDAGOGY	.2495	.6335
AGE	-.5154	.2953
RACE	-.1025	.8469
SCORE	-.0797	.8807
SES	-.2193	.6763
GENDER	-.1991	.7053

The second question is “do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of students who complete graduation requirements within four years?”

The researcher performed a linear correlational analysis between the independent variable Pedagogy and the dependent variable Student Success and calculated a Pearson's $r = 0.6716$ ($p = .1441$).

The researcher also performed a linear correlational analysis between each of the other independent variables and the dependent variable Student Success and calculated Pearson's r and p -values for each of them. The results are found in Table 9.

Table 9

Linear Correlation with Student Success

INDEPENDENT VARIABLE	PEARSON CORRELATION COEFFICIENT (r)	P-VALUE
PEDAGOGY	.6716	.1441
AGE	-.6017	.2063
RACE	-.4748	.3413
SCORE	-.0857	.8717
SES	-.2787	.5927
GENDER	-.4138	.4147

The third question is “do community colleges that have a higher proportion of mathematics instructors with formal pedagogical training also have a higher proportion of first time full time students who return for a second year?”

The researcher performed a linear correlational analysis between the independent variable Pedagogy and the dependent variable Student Retention and calculated a Pearson's $r = 0.1891$ ($p = .7197$).

The researcher also performed a linear correlational analysis between each of the other independent variables and the dependent variable Student Retention and calculated Pearson's r and p-values for each of them. The results are in Table 10.

Table 10

Linear Correlation with Student Retention

INDEPENDENT VARIABLE	PEARSON CORRELATION COEFFICIENT (r)	P-VALUE
PEDAGOGY	.1891	.7197
AGE	-.8536	.0306
RACE	-.9112	.0115
SCORE	.6334	.1770
SES	-.3029	.5595
GENDER	-.7044	.1182

Summary of the Study

The purpose of this study was to uncover any relationship between the academic success of community college students and the formal pedagogical training of the mathematics faculty by examining the statistical correlation between the proportion of

students at a college who graduated within four years with the proportion of mathematics faculty at the college who have formal pedagogical training. Additionally, this study examined the statistical correlation between the proportion of students at a college who return for a second year with the proportion of mathematics faculty at the college who have formal pedagogical training. Finally, the study examined the statistical correlation between the proportion of developmental math students who also complete College Algebra within the first year with the proportion of mathematics faculty at the college who have formal pedagogical training. Pearson r were calculated on the basis of the proportions from a sample of 6 rural community colleges in Mississippi who were named as 2017 Aspen Prize eligible schools.

CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

There is not enough statistical evidence to reject the null hypothesis of no correlation between the independent variable Pedagogy and the dependent variable Developmental Success ($p = .6335$). Therefore, we conclude that community colleges that have a higher proportion of mathematics instructors with formal pedagogical training do not necessarily have a higher proportion of developmental mathematics students who successfully complete College Algebra in the first year.

Similarly, there is also a lack of statistical evidence to support the conclusion that there is any correlation between Developmental Success and any of the other five independent variables in the study (Age, Race, Score, SES, or Gender).

There is also not enough statistical evidence to reject the null hypothesis of no correlation between the independent variable Pedagogy and the dependent variable Student Success ($p = .1441$). Therefore, we can conclude that community colleges that have a higher proportion of mathematics instructors with formal pedagogical training do not necessarily have a higher proportion of students who complete graduation requirements within four years.

Similarly, there is also a lack of statistical evidence to support the conclusion that there is any correlation between Student Success and any of the other five independent variables in the study (Age, Race, Score, SES, or Gender).

There is also not enough statistical evidence to reject the null hypothesis of no correlation between the independent variable Pedagogy and the dependent variable Student Retention ($p = .7197$). Therefore, we can conclude that community colleges that have a higher proportion of mathematics instructors with formal pedagogical training do not necessarily have a higher proportion of first time full time students who return for a second year.

Similarly, there is also a lack of statistical evidence to support the conclusion that there is any correlation between Student Retention and three of the other five independent variables in the study (Score, SES, or Gender). However, there is a statistically significant negative correlation between Age and Student Retention. We can conclude that colleges with a higher mean student age experience a lower proportion of first time full time students who return for a second year. There is also a statistically significant negative correlation between Race and Student Retention. We can conclude that colleges with a higher proportion of non-white students experience a lower proportion of first time full time students who return for a second year.

Conclusions

The results of this study show that among the six participating colleges there is no significant correlation between the proportion of full time mathematics instructors with formal pedagogical training and the success or retention of students. There are several factors that may have contributed to this conclusion.

The small size of this study may have caused a potential correlation between Pedagogy and Student Success to be understated. While the p-value of .1441 was not statistically significant, it indicated that there could be some relationship between these factors. In a larger sample, that relationship may appear more significant. Adams and Mix (2014) suggest that faculty meeting in friendship groups recognize value from the pedagogical ideas presented in the groups by members who are education faculty. Fike and Fike (2007) also identify a relationship between faculty education and student success in developmental students. Many other factors have been noted in the research as significant related to student success. DePaola, Ponzo, and Scoppa (2013) pointed out that smaller class size positively impacted student success. Wolfe and Williams (2014) and Reyes (2010) both found that student success improved with older students. While a p-value of .1441 is not statistically significant, it may indicate that colleges with a higher proportion of full time mathematics faculty who have formal pedagogical training may also have a higher proportion of students who complete a degree within four years.

The homogeneity of the colleges in the study may have contributed to the difficulty in establishing statistical significance. All of the colleges that we studied were high performers. The Aspen Foundation had recognized all of them for their effectiveness. Therefore, any differences in student success and retention may be masked by the similarities between the colleges.

The proportion of full time mathematics faculty with formal pedagogical training may not completely represent the competency of the faculty with regards to pedagogy, the art and science of teaching and learning. Many faculty members may have training in pedagogy that is of a less formal nature. Robinson and Hope (2013) pointed out that

instructors in higher education have identified a need for pedagogical training at the collegiate level. Many professors and instructors have likely sought to improve their teaching skills. They may have attended a professional development seminar, they may have served as a graduate teaching assistant while earning a master's degree in their subject area, or they may have engaged in conversations with other professionals about teaching. Therefore, faculty members may have been trained in pedagogy without earning any formal credentials.

While not the focus of this study, some interesting relationships were noticed. There is a statistically significant negative correlation between the mean age of students and the proportion of first time full time students who return for a second year ($p = .0306$). The research is mixed in its evaluation of this relationship. Fike and Fike (2008) concluded that age is not a significant factor in retention, but Windham (2014) found that age was significant. Pruett and Absher (2015) suggest that the most important factor in retention is student GPA followed closely by student engagement on campus. A negative correlation between Age and Student Retention may suggest that these colleges do a great job attracting and serving returning students, part time students, and students over the traditional age, but they may not do as well serving traditional full time freshmen students. It may also indicate that those same colleges have a large number of students who transfer to other schools after only one year.

There is also a statistically significant negative correlation between the proportion of non-white students and the proportion of first time full time students who return for a second year ($p = .0115$). This relationship may indicate a difference in cultural practices

and norms, as well as systemic structural supports. However, the existing research often finds no significant relationships between ethnicity/race and student retention.

While not statistically significant, there appear to be some additional relationships that may warrant further study. There is a potential that a negative correlation exists between the mean student age and the proportion of students who graduate within four years ($p = .2063$). This may suggest that colleges that do a great job attracting and serving returning students, part time students, and students over the traditional age may not do as well helping those students earn a credential. It may also indicate that those same colleges have a significant number of students who transfer without earning a degree or who never intended to earn a degree when they enrolled.

There is also the possibility of a positive correlation between mean ACT score and the proportion of first time full time students who return for a second year ($p = .1770$). This relationship seems logical since the ACT score is designed to be an indicator of college readiness. A higher mean ACT seems to indicate a student body that has a higher proportion of college ready students. Therefore, it comes as no surprise that they would also show a higher proportion of students returning for a second year. This seems to also be the case with Pruett and Absher (2015). They found a positive correlation between GPA and student retention. Students who perform at a higher level are more likely to continue their education.

There may also be a negative correlation between the proportion of female students and the proportion of first time full time students who return for a second year

($p = .1182$). This may reflect the tendency of female students to leave school from time to time often due to biological, systemic, and cultural challenges that are often specific to women.

Recommendations

The purpose of this study was to uncover any correlation between the academic success of community college students and the formal pedagogical training of the mathematics faculty. No correlations could be proven statistically. However, a positive correlation between the proportion of mathematics faculty with formal pedagogical training and the proportion of students who graduate within four years showed some promise ($p = .1441$). The importance of pedagogically trained faculty is also supported in articles by Jansen (2011), Robinson and Hope (2013), Adams and Mix (2014), and Fike and Fike (2007). Therefore, further research should continue to investigate this relationship.

Further research into the relationship between student success and faculty preparation should consider using a larger, more diverse, sample of community colleges. Researchers with enough resources may even utilize colleges from multiple states. If possible, the colleges in the sample should be randomly chosen. The sample colleges should be a mix of rural, urban, and suburban. The sample should contain high performing colleges as well as mediocre and low performing colleges.

Further research may also consider identifying the qualifications of faculty through some other method than major or degree earned. Lifelong learning experiences are not limited by the undergraduate major or graduate degree earned. It is quite likely

that college instructors continue to expand their understanding of pedagogy long after they have earned their diplomas.

Further research could also investigate additional subject areas. College Algebra is not the only “gate keeper” course that proves to be a hurdle for many college students. English Composition is also a course that many students struggle with. Therefore, the relationship between student success and the preparation of English faculty members is worthy of investigation.

Further research into some of the additional relationships that were discovered may be warranted. Two statistically significant correlations were unveiled in this study that should be investigated further. First, the mean student age is negatively correlated with student retention. That means that colleges with an older student population demonstrate a lower rate of student retention.

The second significant correlation that deserves some additional attention is the proportion of minority students is negatively correlated with student retention. That means that colleges with higher proportions of non-white students demonstrate a lower rate of student retention. Additional study is necessary to identify the reasons for this correlation.

The study also uncovered three more relationships that could be investigated. First, there is a possible negative relationship between mean student age and student success. That means that colleges with a higher mean student age demonstrate a lower proportion of students who graduate within four years. Also, there is a possible positive relationship between ACT score and student retention. That means that colleges with a higher mean student ACT score demonstrate a higher proportion of students who return

for their second year. Finally, there is a possible negative relationship between the proportion of female students and student retention. This means that colleges with a higher proportion of female students demonstrate a lower proportion of students who return for their second year.

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APPENDIX A
INFORMATION REQUEST SCRIPT

Dear _____,

My name is Douglas Donohue. I am a doctoral student in Community College Leadership at Mississippi State University as well as a Mathematics faculty member at Pearl River Community College Forrest County Center in Hattiesburg.

The proposal for my dissertation entitled “The Effect of Formal Pedagogical Training of Mathematics Faculty on Community College Student Success and Retention” has recently been approved by the Institutional Review Board at Mississippi State University and by the CIRE committee of the MACJC.

I am writing to ask for your help in gathering two small but extremely vital pieces of information about your college for my dissertation research.

First, I would like to know the total number of full time mathematics faculty members at _____ Community College.

Second, I would like to know the number of those full time mathematics faculty members who have either a Bachelor’s degree in Education or a Master’s degree in Education.

As I am only surveying the eight Mississippi community colleges that were named to the 2017 Aspen prize list, it is essential that I am able to collect information from each and every college.

I intend to use this information to complete my dissertation on the possible correlations between the formal pedagogical training of mathematics faculty and student success in developmental math courses, degree completion, and student retention. These results may be of use to the community college community in the future regarding hiring practices, professional development, and accreditation. There is already at least one college in Mississippi that has made pedagogical training a part of their Q.E.P.

Thanks for your help.

Sincerely,

Doug Donohue

APPENDIX B
INSTITUTIONAL REVIEW BOARD
APPROVAL LETTER

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE: July 01, 2016
TO: Donohue, Douglas, MEd, Educational Leadership
FROM: Roberts, Jodi, HRPP Officer, MSU HRPP
PROTOCOL TITLE: The Effect of Formal Pedagogical Training of Mathematics Faculty on Community College Student Success and Retention
FUNDING SOURCE: NONE
PROTOCOL NUMBER: 16-257

This letter is your record of the Human Research Protection Program (HRPP) approval of this study as exempt.

On July 01, 2016, the Mississippi State University Human Research Protection Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The application qualified for exempt review under CFR 46.101(b)(4).

Exempt studies are subject to the ethical principles articulated in the Belmont Report, found at www.hhs.gov/ohrp/regulations-and-policy/belmont-report/

If you propose to modify your study, you must receive approval from the HRPP prior to implementing any changes. The HRPP may review the exempt status at that time and request an amendment to your application as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so.

The MSU IRB approval for this project will expire on December 31, 2016. If you expect your project to continue beyond this date, you must submit an application for renewal of this HRPP approval. HRPP approval must be maintained for the entire term of your project. Please notify the HRPP when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the HRPP by phone at 325.3994 or email irb@research.msstate.edu. We wish you success in carrying out your research project.

Review Type: EXEMPT
IRB Number: IORG0000467



APPENDIX C
INSTITUTIONAL REVIEW BOARD AMMENDMENT
APPROVAL LETTER

