January 2019

An Examination On The Progression Of Students Assigned To Developmental Or College Level Math At A Tribal Community College

Rhonda Blanche Gustafson

AN EXAMINATION ON THE PROGRESSION OF STUDENTS ASSIGNED TO DEVELOPMENTAL OR COLLEGE LEVEL MATH AT A TRIBAL COMMUNITY COLLEGE

By

Rhonda Blanche Nelson-Gustafson
Associate of Arts, University of North Dakota, 1986
Bachelors of Arts, University of North Dakota, 1986
Masters of Arts, University of North Dakota 1996

A Dissertation
Submitted to the Graduate Faculty
of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of
Doctor of Philosophy

Grand Forks, North Dakota

December 2019

This dissertation, submitted by Rhonda Blanche Nelson-Gustafson in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

_____
Dr. Steven LeMire, Chair

_____
Dr. Zarrina Azizova

_____
Dr. Carolyn Ozaki

_____
Dr. Deborah Worley

This dissertation is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

_____
Dr. Chris Nelson
Associate Dean of the School of Graduate Studies

_____
Date

PERMISSION

Title AN EXAMINATION ON THE PROGRESSION OF STUDENTS ASSIGNED TO DEVELOPMENTAL OR COLLEGE LEVEL MATH AT A TRIBAL COMMUNITY COLLEGE

Department Educational Leadership

Degree Doctor of Philosophy

In presenting this dissertation in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the library of this University shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my dissertation work or, in his absence, by the Chairperson of the department or the dean of the School of Graduate Studies. It is understood that any copying or publication or other use of this dissertation or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my dissertation.

Rhonda Blanche Nelson-Gustafson
June 14, 2019

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The writing of this dissertation has been the most significant academic challenge I have ever had to face. Without the support, patience, and guidance of the following people, this study would not have been completed. It is to them that I owe my deepest gratitude. I wish to express my sincere appreciation to the members of my advisory committee for their guidance and support during my time in the doctoral program at the University of North Dakota. In particular, my advisor, Megwich, Dr. LeMire.

I would like to thank my classmate, Dr. Wanda Laducer, for the time and effort she spent helping me continue on in this journey. Most importantly I would like to acknowledge my family and in particular my son's, for them I didn't quit. Family members have been lost in this journey that would be most proud of me today, my maternal grandmother, Blanche Morin, and my dad, Dan Nelson, in memory of them, and for my mom who thankfully is still here, I didn't quit. Three grandchildren were gained in this process Easton, Cade, and Lillian, who are my heart and soul. For them, I didn't quit. Thank you husband for your support and hoping that I would get this done!

Thank you to the person I drove into Grand Forks with many years ago in a brown rambler with every fifty dollars to go to college at UND, the woman who paved the way for me, my inspiration, and my best friend, my aunt Paula. There are so many others that I have to thank for their help and patience during this long process, thank you all.

ABSTRACT

It has been agreed that postsecondary credentials are critical in contributing to the economic and global demand that the U.S. produces well-educated and credentialed citizens in or to ensure that the country remains economically competitive in the world. The problem is when admitted and after being assessed, older students and far too many graduating high school students are arriving underprepared for college-level work, and college readiness can often be the greatest obstacle to students' success, in particular mathematics. With high dropout or stop-out rates in conjunction with low retention and graduation rates, American Indian student success is threatened.

Various explanations have been advanced to explain developmental students' lack of progression, including inadequate test preparation, insufficiently predictive exams, poorly aligned curricula, and the sheer length of time and financial resources required to finish a long sequence of courses. Each explanation implies that the developmental system is broken and that one or more specific fixes will mend it.

For this study, quantitative research is used to conduct an examination of the progression of students enrolled at a tribal community college from initial placement in developmental math [remedial course] or to the first college-level math course. Results indicate that fewer than one-half of the students who are referred to remediation actually complete the entire sequence, and fewer earn an educational credential.

CHAPTER I

INTRODUCTION

> *"A University for Indians is the greatest step that we educated Indians could make in uniting our people… It would eliminate the general conception of the people that an Indian consists of only feathers and paint. It would single us out to the Indians and the rest of the world as REALLY PROGRESSIVE INDIANS. It would give us a better influence with the rising generation, by setting out our character in such conspicuous a manner as to be the means of being observed and imitated by them."*
>
> March 2, 1911, August Breuninger

Introduction

Although developmental education in college has been part of education since the 1840s (Handel & Williams, 2011), remedial courses have been more prevalent in the last 30 years (Handel & Williams, 2011). In addition, developmental education has gained increasing attention among stakeholders (Handel & Williams, 2011). As America climbed out of the Great Recession, the workers to be left behind are those without postsecondary credentials (Carnevale, Smith, & Strohl, 2010). While the global economy increasingly demands high-skilled labor, the United States is facing an unprecedented shortage of college-educated workers, making postsecondary degree attainment a national priority (Boylan, Brown, & Anthony, 2017). The Georgetown Center on Education and the Workforce reported in 2011 (Merisotis, 2018) that between 1990 and 2010 the demand for college-educated workers increased by 2.0% per year whereas the production of graduates by higher education institutions increased only 1.5% per year. The authors also proposed that U.S. higher education would need to produce 15 million more

baccalaureate degree holders, 4 million more postsecondary certificate holders, and 1 million more associate degree holders by 2025 in order to meet the workforce needs (Merisotis, 2018).

Based on research and from my career experiences, many students enrolling in community colleges lack the academic skills deemed necessary to do college-level work (Butrymowicz, 2017). They are required to take developmental (remedial) courses before enrolling in coursework that confers credits and leads to a degree. However, participation in developmental courses may negatively impact college academic program choice, persistence, and completion (Boatman & Long, 2013). Unfortunately, such students all too often do not complete their prescribed developmental math coursework, and they "stop out" or out of college altogether (Quint, Jaggars, & Byndloss Asya Magazinnik, 2013). Less than 10% of two-year students in developmental education graduate within drop three years (Tinto, 2004).

Two-year colleges play an essential role in supplying students with the academic and training they need to succeed in the labor market. But, in the United States, almost two-thirds of community college students are not academically prepared for college-level coursework (Bailey, Jaggars, & Jenkins, 2015). Colleges have addressed this lack of college readiness with developmental education programs. The research revealed common definitions of remedial and developmental education. Attewell, Lavin, Domina, and Levey (2006), defined remedial education and developmental education as college preparation. Kirst (2007) defines remedial and developmental education as coursework that is below the college-level. The most common types of remedial or developmental courses are provided in the areas of writing, reading, and mathematics (Cohen & Brawer,

2002). It is important to note for the purpose of this study, remedial education and developmental education are defined as postsecondary courses designed to prepare a student for college-level academics. The terms “remedial” and “developmental” are often used interchangeably in the literature and also be used interchangeably in this study. The purpose of developmental education is to provide students with weak academic skills the opportunity to strengthen those skills in preparation for college-level coursework (Bailey, Jeong, & Cho, 2010; Bettinger & Long, 2005).

Most academic majors require at least one math course; therefore, students need to succeed in math to succeed in college. But, far too many students graduate from high school underprepared for college-level work, and college readiness in math can often be the greatest obstacle to students’ success. Sixty-eight percent of community college students require at least some developmental education (Center for Community College Student Engagement [CCSE], 2016). A referral that could require a student to take a year or more of developmental courses before being able to enroll in credit-bearing, college-level classes (Bailey et al., 2010). Although developmental courses may provide the necessary support to some underprepared students, a growing body of evidence suggests that students placed in developmental education, particularly those placed in developmental math, are highly unlikely to obtain an associate degree or transfer (Fong, Melguizo, & Prather, 2015). Colleges are addressing this lack of college readiness with math developmental education programs, both effective and ineffective.

Over the last several years, a large amount of research and philanthropic attention has been directed at setting goals for increasing the number of college graduates in the U.S. The Developmental Education Initiative (DEI), funded by the Bill & Melinda Gates

Foundation and by Lumina Foundation, was an effort to remedy this situation. Fifteen community colleges were selected to expand preexisting interventions or put in place new ones directed toward helping students move through developmental coursework more quickly and more successfully. In 2009, the Bill & Melinda Gates Foundation set the goal of doubling the number of college degrees and certificates among low-income students (Bill & Melinda Gates Foundation, 2009). Recently in 2013, the Lumina Foundation established the goal of having 60% of Americans attain a quality degree, certificate, or other postsecondary credentials by 2025 (Lumina Foundation, 2015). Former President Obama set a goal in 2011 that by 2020, America will once again have the highest proportion of college graduates in the world (Office of the Press Secretary, December 02, 2011).

In agreement, postsecondary credentials are key to ensuring that the United States produces economically contributing members of society's workforce. It also has to be asserted that postsecondary opportunities stretch beyond traditionally recognized needs. They also contribute to the capacity building of sovereign tribal nations (Nelson & Frye, 2016). In fact, according to the most recent available data, there are over 560 Native nations within the United States representing the Native American/Alaska Native citizens (Winters, 2012; Brayboy & Castagno, 2011). Within those Native nations, the American Indian population has increased 39% from 2000 to 2010, but Native college student enrollment remains static (Nelson & Frye, 2016), representing 1% of the total undergraduate student enrollment at degree-granting institutions (Winters, 2012; National Center for Education Statistics [NCES], 2011). A significant challenge in higher education is to narrow the educational attainment gap.

Background

A student entering an open-access two-year institution is typically assigned to a set of courses that are considered appropriate to his or her level of academic preparation. For most community colleges, this assignment is based on standardized placement exams that measure English, reading, and mathematics skill levels (Hughes & Scott-Clayton, 2011). Students who score above a "cut score" are viewed as ready to take college-level courses in that subject area, while students who score below the "cut score" are referred to developmental coursework in that subject area. In this study the terms assignment and placement are used interchangeably to denote the word used when students are assigned to developmental [remedial] or college-level courses.

Developmental courses are typically structured as course sequences, which completed successfully can eventually lead to college-level math and English courses. The logic behind requiring students to take developmental courses is to prepare student college-level coursework. Estimates suggest that around 40 to 50% of all first-year students in college today are taking some form of developmental coursework (Jimenex, Sargard, Morales, & Thompson, 2016). This is also true for students attending tribal community colleges. According to the American Indian Higher Education Consortium (AIHEC, 2012), 66% of entering Tribal and Community Colleges and Universities (TCUs) students require some developmental education. One other tribal community college reported in the Breaking Through Project in 2009 that approximately 94% of entering students required remediation in at least one basic skill area (Thunder, Anderson, & Miller, 2013). The challenge is compounded when we also consider these same

students are likely first-generation college students transferring in from the tribal community high school or GED graduate.

To broaden the goals of development education beyond ensuring that students are successful in their first college-level courses, it's to provide students with the additional preparation needed to succeed in later courses, in addition, to enable institutions to maintain standards of quality and rigor in college courses. This goal makes good sense if students are not adequately prepared for college-level work, developmental education should help students catch up. Recent research, however, has challenged the notion that the traditional developmental education process improves students' long-term academic success, given that the majority of students who enroll in development courses never complete their requirements, much less move on to college-level coursework (Bailey et al., 2010). Previous research has shown that lengthy developmental sequences can have a cooling out effect on the students because it adds time towards completing a degree (Melguizo et al., 2016).

This can act as a barrier to completion (Melguizo et al., 2016), and increase the amount of money students need to pay for college. The student usually pays tuition fees when enrolling in developmental courses but often does not receive the degree-applicable credit for these courses. As a result, there are monetary and time costs associated with ineffective developmental education for both the student and the institution (Melguizo, Hagedorn, & Cypers, 2008). As researchers and practitioners work to clarify the problems with the current system and test potential solutions, have focused on improving the developmental curriculum or course pedagogy (Edgecombe, 2011; Hodara, 2011;

Perin, 2011), while others have examined the assessment process itself (Hughes & Scott-Clayton, 2011; Benezia, Bracco, & Nodine, 2010).

Statement of the Problem

Low rates of college completion are a major problem in the United States. To expand on the problem, one of the biggest challenges tribal community colleges face is how to counteract low persistence and historically lower graduation rates than any other ethnic minority group. According to a study of first-year college students, Indigenous students have the lowest level of retention after the first year of college (Stewart, Lim, & Kim, 2015).

Nearly two-thirds of students who enroll in a two-year institution test below college-ready in mathematics (Achieving the Dream [ATD], 2019). Of these students, 50% place two or more levels below college-ready in math. Each of these individuals enrolled in college with the intent of attaining a degree, yet 72% of them will not graduate, even after eight years (ATD, 2019). Developmental mathematics is a barrier to educational achievement. It represents a serious concern for students and high education policymakers and is preventing students from achieving their educational goal because these students never complete these courses (Bonham & Baylon, 2011)

Purpose of the Study

Developmental education has increasingly become part of the national debate in higher education (Bonham & Boylan, 2011). This is particularly true for developmental mathematics courses which, in general, have the highest rates of failure and non-completion of any developmental subject area (Bonham & Boylan, 2011). The purposes for focusing on developmental math in this study are: a larger proportion of students are

placed into developmental math than developmental English, tend to be more consistent across colleges, and fewer students complete the developmental math sequence and/or math pre-requisite for attaining a certificate or degree than English (Melguizo et al., 2015).

There is scant research on the success or lack of success that has been experienced for students attending tribal community colleges. In particular, the placement of developmental math, the progression to college-level math, its effects on degree completion, and this study attempts to fill in the gap. The purpose of the study is to understand if there is a difference in student persistence and outcomes based on their placement to either developmental or college-level math.

Research Questions

Therefore, the goals of this study were to ascertain answers to the following research questions:

1. Is there a difference in students completing the first corresponding college-level math course in three years for those placed in developmental math courses versus those not placed?
2. Is there a difference in student's persistence when completing the math sequence in three years, for students placed in a developmental math course versus those not?
3. Is there a difference in students earning an educational credential in three years of those placed in developmental math coursework versus those not?

The Significance of the Study

Despite the need, American Indians/Alaska Natives do not access higher education at the same rate as their non-native peers (Nelson & Frye, 2016). With high dropout and stop-out rates, American Indian student success is threatened. Almost 30

years ago, a study by Ponterotto (1990) revealed that the number of American Indian students who obtained undergraduate degrees was disproportionate to the representation of their population in the U.S., a trend that still continues (Starks, 2010). Because the trend continues that over half of all tribal students enroll at tribal community colleges, which covers over 80% of Indian Country American Indian Higher Consortium (AIHEC, 2012), it is important to research the challenges encountered by American Indian college students to meet their needs and address hurdles to their success. Success in terms of educational credentials that enables the building of native nations and contributes to the workforce of the United States. This undertaking is noteworthy given that tribal colleges and universities are vital to the future of American Indian communities, and data-driven decisions are critical to their continued existence.

Theoretical Framework

Astin's 1993 Input–Environments-Outcomes (I-E-O) Model serves as the theoretical framework for the study. The origins of the model come from Astin's examination of the graduate program's ability to produce Ph.Ds. Astin questioned to what extent the outputs of a program were a condition of the quality of its inputs (York, Gibson, & Rankin, 2015). Early explorations convinced Astin that accurate assessment required correctly describing student inputs, the educational environment students experience, and student outcomes (York et al., 2015).

The model provides a framework for evaluating and understanding the outcomes of student populations. Astin’s model has served as a foundation for countless studies related to college student outcomes and, perhaps most notably, as the basis for Terenzini and Reason’s (2005) conceptual framework for studying college impacts (York et al.,

2015). The contextual model is composed of three elements, which are represented with the letters A, B, and C (see Figure 1) for a visual representation of the model, and the relationships of the three elements represented.

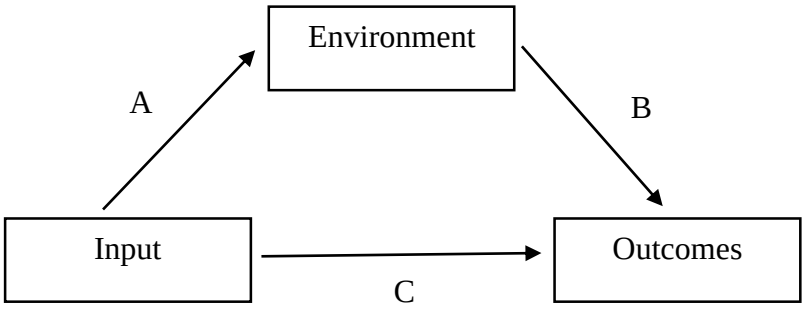

FIGURE 1. Astin I-E-O Model.

Inputs "refers to those personal qualities the student brings initially to the education program (including the student's initial level of developed talent at the time of entry)" (Astin, 1993, p. 18). Inputs also can be such things as antecedent conditions or performance pretests that function as control variables in research. Examples of student inputs might include demographic information, educational background, political orientation, degree aspiration, disability status, career choice, major field of study, and the reason for attending college (Astin, 1993). The inclusion of input data when using the I-E-O model is imperative because inputs directly influence both the environment and outputs, thus having a “double” influence on outputs, one that is direct and one that indirectly influences through the environment.

Environment "refers to the student's actual experiences during the educational program" (Astin, 1993, p. 18). The environment includes everything and anything that happens during the program course that might impact the student, and therefore the outcomes measured. Environmental items can include things such as educational

experiences, practices, programs, or interventions. Environmental factors may include the program, personnel, curricula, instructor, facilities, institutional climate, courses, teaching style, friends, roommates, extra-curricular activities, and organizational affiliation (Astin, 1993). Outcomes "refer to the 'talents' we are trying to develop in our educational program" (Astin, 1993, p. 18). In education, outcome measures have included indicators such as grade point average, exam scores, course performance, degree completion, and overall course satisfaction.

In addition to these three relationships (A, B, & C), this study looked at the various interactions and the effects with the intent to understand students as they passed through various stages in their educational experiences. Having the knowledge of how students move through a system is essential to strategically study, plan, and design best practices for successful student experiences as a result of the newly acquired knowledge. To frame this study using the I-E-O model in the context of thinking about one aspect of the college experience from when the student enters the institution to when the student exits the institution. This theoretical model has many applications in the world of higher education, researchers have continued to use this model to frame their studies (Leonard, 1996).

Assumptions

This study is conducted and written from the perspective of a tribal member uniquely positioned with a 27+ year career within tribal community colleges. Years comprised of teaching, academic advising, and administration; forming a holistic understanding of the process, procedures, and policy in this regard, or insider researcher. It has been my assumption over those years that our students are not first assigned

effectively into math courses in particular, and then compounded by ineffective delivery methods. As a result, factors into the historically low retention, persistence, and graduation rates; and the overall academic success of first-year tribal college students. Developmental education is one of the largest challenges faced by tribal community colleges today. From my experiences, I have concluded that little attention is being paid to how tribal community colleges are determining academic readiness, how tribal college students start college, and how they progress through college to completion.

A major assumption of the college is that the students who choose to enter college can be successful, as measured by completion of the certificate and degree programs that they pursue. It is assumed that enrolling students in developmental courses will assist the student, who enter without adequate skills in Math, to be successful in their college studies. Additionally, this research was conducted with these basic assumptions: the data collected by the institution were accurate, valid, and reliable; the students in this study were representative of past and future students; the developmental and college-level math courses were essentially the same during the timeframe analyzed, regardless of instructor, time of day, or time of the year taught.

Limitations

Several limitations exist. First, the population that consists of student data used for this study is from a tribal community college that may be clearly different in many respects from mainstream community colleges. The results obtained from this study are specific to this tribal college may not be generalized to non-tribal colleges. Due to the diversity of the American Indian tribes and nations in terms of culture, beliefs, and the nature and level of involvement with their tribal college, summary data obtained in this

study are not representative of every tribal college, and inferences that could be drawn from the data are not appropriate for all tribal colleges.

Due to the comparatively small number of tribal colleges and universities to the total number of colleges and universities in the United States, and due to the relatively small number of American Indian students in higher education matched to the total number of students in higher education in the United States, and finally, due to the small percentage of American Indians in the population of the United States, it is not possible to generalize the results of this study to larger populations, or to infer trends identified among larger populations to American Indian populations.

Delimitations

This study is delimited to the selected American Indian tribal college in the United States, and to a sample of those students. This study is delimited to a focus on developmental [remedial] mathematics in the college placement courses, and does not include English or reading.

Definition of Terms

Various terms were found during this scholarly literature review inquiry that has various meanings and in a variety of contexts. The following list of definitions is offered to specify the intent of this researcher in use of these terms:

1. First-Generation Student: Often, first-generation students are categorized simply as those who are the first in their family to attend college. Yet, this leads to questions about the postsecondary experiences of extended family members, older siblings, and even non-family adults who have important roles in the lives of students. Many institutions have chosen to use the federal definition officially developed for TRiO

program acceptance and to determine eligibility for Pell Grants which indicates first-generation students come from families where their biological parents did not complete a four-year college degree (NASPA Foundation, 2017).

2. American Indian/Native American/Native: The expression American Indian, Native American, and native, are used interchangeably in the study as referenced in the context of time. Each refers to the Indigenous population in North America and those who identify as Native American or Alaska Native. This includes those who are members or descendants of both federally and state-recognized tribes.
3. Two-Year Colleges: Often called a “junior” college or “community” college, is an institution that offers two academic years of education. Some two-year colleges are state-supported, or public: others are private (Homeland Security, 2019).
4. Gateway Course: The first entry courses that satisfy the graduation requirement for a program of study. A gateway course is a course following completion of the developmental math sequence (Park, Woods, Hu, Jones, & Tandberg, 2016).
5. Tribal Community College or University (TCU): Defined in the Higher Education Act of 1965, "Tribal College or University" means an institution that qualifies for funding under the Tribally Controlled Colleges and Universities Assistance Act of 1978 or the Navajo Community College Act. These institutions emulate “community” colleges, with the exceptions that tribal community colleges are usually located on an Indian Reservation, tribally controlled, federally supported, and operate under dual missions. Today several of the two-year tribal community colleges have gained university status and provide higher-level, advanced degrees such as bachelor's and master’s, thus referred to as Tribal Community Colleges or Universities (TCU’s). In

this study, the institution identified is a two-year tribally controlled community college.

6. Persistence: A student's behavior that results in a student-continuing enrollment at an institution beyond the first year (Hagedorn, 2005).
7. Retention: Retention rates measure the percentage of first-time undergraduate students who return to the same institution the following fall, and graduation rates measure the percentage of first-time undergraduate students who complete their program at the same institution within a specified period of time (National Center for Education Statistics [NCES], 2019).
8. Voluntary Departure: The student's decision to depart from the institution for one or several reasons. The voluntary departure does not include leaving the institution due to academic dismissal or conduct dismissal (Tinto, 1993).
9. Educational Credential: Often refer to academic or educational qualifications, such as degrees or diplomas that you have completed or partially-completed. "Credentials" can also refer to occupational qualifications, such as professional certificates or work experience
10. Academic Year: The period-of-time generally extending from August to June: equated to two semesters.
11. Postsecondary Institution: An institution that has as its sole purpose or one of its primary missions, the provision of postsecondary education.
12. Open Admission: As admission policy whereby the school will accept any student who applies.

13. Remediation/Remedial Course: Courses defined by the National Center for Educational Statistics (NCES) as "courses in reading, writing, or mathematics for college students lacking skills necessary to perform college-level work at the level required by the institution" (McCleary, 1997). In an effort to avoid possible negative connotations associated with the term “remedial,” practitioners often use the term “developmental” to describe the courses and services offered to students below college-level (Boatman & Long, 2013). Therefore, the terms “remedial” and “developmental” are often used interchangeably in the literature and also be used interchangeably in this study.
14. College-Level Math Course: Any math courses that students receive college credit upon completion and is required for the completion of a degree.
15. Academically underprepared student. A student not prepared to succeed in one or more college-level courses and has the potential for college success when appropriate educational enrichment and support services are provided (Conley, 2007).
16. College readiness. The level of preparation a student needs in order to enroll and succeed, without remediation, in a credit-bearing general education course at a postsecondary institution that offers a baccalaureate degree or transfers to a baccalaureate program (Conley, 2007).
17. Developmental education course**.** Any course that utilizes principles of cognitive and student development that is designed to promote both affective and cognitive development, and designed to prepare students to do college-level coursework (Arendale, 2012).

18. Sequence completers. Students who passed the highest-level developmental course in their referred sequence are defined as sequence completers.
19. Support services**.** Support services include a wide range of services offered by community colleges that include group tutoring, learning communities, supplemental instruction (SI), workshops, orientation, student success courses, and learning labs (Bailey, 2009; Boylan & Saxon, 2012). These services are meant to assist students outside of the classroom setting and contribute to their overall development as students (Bailey, 2009; Pierce, 2017).

Organization of the Dissertation

This study is organized into five separate chapters that build upon one another. The first three chapters of this dissertation serve as the groundwork for understanding the capacity and purpose of this research study. Chapter one serves as the introduction to the study. It contains an overview of the study, statement of the problem, the purpose of the study, the significance of the study, research questions, assumptions, limitations, delimitations, and the definition of terms. Chapter two contains the results of the review of the literature related to developmental education. The chapter sets the theoretical base for developmental research and is followed up with examples of empirical research that has been conducted. Chapter three describes in detail the methodology to be used in this research paper, as well as defining the sample population and setting in which the data were gathered. The chapter defines the variables used in the research project. The final two chapters include the results and recommendations. All the results of the statistical tests are found in chapter four. This chapter presents all of the findings in response to the

research questions. The fifth and final chapter presents a discussion, the implications, and directions for future research.

CHAPTER II

LITERATURE REVIEW

This chapter consists of an introduction, and then review of the literature as it was related to the tribal college movement, college readiness, assessment and placement tests, delivery methods, and researh in regard to the broad subject of developmental education. With the newly acquired understanding to serve data-driven research be used to make well-informed transformations in design processes and policies for the institution in this study.

Introduction

Broadly, this study addresses the issues of progression and completion that are critical to TCUs but not unique to them. In this study, a quantitative research design was used to conduct the analysis of the progression of students enrolled at a tribal community college from initial placement in developmental math [remedial course] or assignment in college-level math. Then to broaden the discussion by moving beyond considerations of the developmental math course and include a focus on the math coursework [sequence]. A sequence is defined as a process that begins with the initial assessment and referral to remediation and ends with the completion of the highest level developmental course (Bailey, Jeong, & Cho, 2010). The same course that upon completion, the students are ready for college-level coursework. Students were tracked as they progressed or failed to progress through their referred math sequence and then analyze those points at which students exited the sequence. The goal was to gain insight into why these students are

unlikely to go on to complete the first college-level math course and in addition, why these students are unlikely to go on to complete an education credential. Graduation rates of 60% or less have proven to be a concern (American Institutes for Research, 2009).

Search Description

The first task in conducting the literature review was to identify and build a journal of keywords to be used for effective searching. Several methods were introduced throughout the course of time in completing the literature review. The first technique introduced early in the doctoral program was to identify literature relevant to the study by examining other studies' references. Early searches, for example, included a broad topic of subject matter relevant to developmental education, remedial coursework, American Indian college students, tribal community colleges and universities, and community colleges.

With an arsenal of keywords, an initial search began of higher education literature utilizing the Educational Resources Information Center (ERIC), EBSCOhost, and Google Scholar databases. These searches yielded multiple articles largely within the field of higher education. The literature review included search techniques that involved using various Internet-based search engines, identifying and searching a number of electronic databases, and employing the learned search terms consistent when conducting a literature review primarily by electronic means.

A cohesive literature review was conducted in such a way that a new framework and perspective on the topic of developmental education. Is related to students attending a tribal community college were generated and three questions relevant to the topic were formulated upon the conclusion. The body of literature that makes up this chapter

includes related studies, have similar hypotheses or share research problems. The literature review is organized around the topic of the study rather than the progression of time, even though the progression of time will be relevant to some factors presented.

Literature Review

Thiel (2008) explained that much of the prosperity of the nation is due to the "innovations that resulted from research and development during World War II and afterward: (p. 45). They also reported, "a decrease in the number of American college graduates who have the skills, especially in mathematics, to power a workforce that can keep the country at the forefront of innovation and maintain its standard of living" (Thiel, 2008, p. 45). These innovations were possible because the United States formerly led the world in mathematics and science education. Today, however, that is not the case.

Postsecondary remediation has been a subject of ongoing debate among policymakers and educators for a long time (Martorell & McFarlin, 2011). Supporters argue that developmental courses and services expand educational opportunities for underprepared students, giving them a chance to gain the competencies necessary for college success and gainful employment. Opponents contend that developmental education is costly and that colleges should not pay for academic preparation that students should have received in high schools (NCES, 2016). Critics add that developmental coursework increases the requirements students need to fulfill before taking college-level courses, thereby prolonging time to degree and potentially hindering transfer and completion (NCES, 2016).

As the debate on postsecondary level developmental education is ongoing, the research on developmental education abundant; the rigorous studies are limited, and there

is considerable uncertainty surrounding the short- and long-term effects (Kurlaender & Howell, 2012). Keeping in mind the relatively short history of tribal colleges and universities, 50 years or less, finding literature related to American Indians in higher education, is limited. Literature related specifically to an individual tribal college is extremely limited, and in terms of American Indian students and the effects of developmental education is almost non-existent. Though there is one recent study that exists relevant to this study that was conducted at a peer institution, Sitting Bull College. Conducted in 2010 titled, "Do they work? Developmental Courses in Mathematics and English at Sitting Bull College." (Bauer, 2010). The results overall were, "that one placement test and one study cannot possibly tell the entire story of the student who is placed in developmental coursework. But that the low success numbers support using other variables as measures of success for students who are placed in developmental coursework."

Recently the Strong Start to Finish initiative sought out data about American Indian, Alaska Native, and Native Hawaiian or other Pacific Islander students in developmental education, but found that disaggregated national student-level data on this important student population is not currently available (Strong Start to Finish, 2019). In contrast to other racial and minority groups, the literature on Native American attainment has stressed cultural relative phenomenon or question. There has been a board range of studies done on American Indians in higher education that have focused on models for student success. The number of studies completed within the last 10 years focusing specifically on American Indian tribal community college students, persistence, and completion is very minimal.

In conducting and composing a theoretical literature review, an examination into the body of theory was accumulated about developmental education and that already exists, the relationships between them, and then developed new hypotheses to be tested. This study expands the previous research conducted at two-year non-tribal community colleges to examine the impact of developmental courses on the academic outcomes of students with varying ability levels who began at a tribal community college.

Tribal College Movement

Recognizing the importance of preserving and growing the nation's Indigenous heritage, Tribal leaders demanded an end to curricula driven by an unnecessary need to indoctrinate Native Americans into white middle-class values and began a political movement of self-determination (Oppelt, 1990). Tribally controlled colleges and universities first emerged in the 1960s as part of this "self-determination" era of Native American education (Carney, 1999; Oppelt, 1990), and from the onset were established to serve a unique mission of sustaining and growing tribal culture. The first tribal college, built-in 1968 by the Navajo Nation of Arizona, was Navajo Community College, now named Diné College (Diné College, 2014). This began a proliferation of tribally controlled institutions, each representing the unique culture of the founding tribe and aimed at meeting the unique needs of the tribal community.

Tribal colleges are similar to mainstream community colleges. However, the element that uniquely distinguishes them from other community colleges is their dual mission: 1) to rebuild, reinforce and explore traditional tribal cultures, using uniquely designed curricula and institutional settings, and at the same time; 2) to address Western models of learning by providing traditional disciplinary courses that are transferable to

four-year institutions (Tierney, 1992). In addition to serving individual students, tribal colleges also have a wider mission: to address issues of social justice as well as the social and economic needs of their tribal communities, through research, instruction, service, and other innovative means that also benefit their tribal communities (Stein, 2003; AIHEC, 1999). This responsiveness to the higher education needs of communities across Indian Country continues to be the strength of TCUs.

In 2019, there are 37 Tribal Colleges and Universities in 16 States (AIHEC, 2019). Several located in counties among the most impoverished counties in the U.S. (AIHEC, 2019). More than 230 federally recognized tribes are represented at TCUs. Students come from 30 states, and 130,000 American Indian and Alaskan Natives rural residence attend TCUs. Today these institutions' largest issues include equity in student appropriations at the federal and state levels, and the potential loss of Title III Strengthening Universities monies October 2019, which accounts for roughly 35 million dollars.

Since many tribal colleges serve large reservation areas without adequate public transportation and do not offer student housing (AIHEC, 2012; His Horse Is Thunder, 2012), the combination of challenges can be overwhelming. Yet students keep coming. But education is, as always, the key to social renewal, and without question the most significant development in American Indian communities since World War II. More than any other single institution, they are changing lives and offering real hope for the future.

College Readiness

The overwhelming majority of high school students aspire to postsecondary education (ACT, 2016). According to the National Center for Education Statistics in the

National Assessment of Education Progress and National Indian Educational Survey, students were asked to indicate whether they planned to go to college or another school full or part-time in their first year after high school. Fifty-seven percent of grade eight American Indian/Alaska Native students in low and high-density public schools and 55% in the Bureau of Indian Education schools indicated that they planned to go to college full time after high school (NCES, 2010).

Despite high educational aspirations, students from some demographic groups are less likely than their peers to enroll in college after high school. Among college enrollees, students from these same demographic groups are less likely to persist in college and complete a degree. Students considered at greater risk than their peers for not persisting to a college degree include economically disadvantaged, underrepresented racial/ethnic minority and first-generation students (ACT, 2013). Traditionally, developmental education has intended to address whatever was missed in high school (Strong American Schools, 2008). But, increasing numbers of students are entering or returning to college underprepared for college-level coursework, and the number of students entering college placed in remedial courses continues to increase (Butrymowicz, 2017). Reports find that across colleges, the percentage of incoming developmental students has more than doubled. Rising from 18% to 41% in the fall of 2011 (Quint et al., 2013). The general purpose of these courses is to provide academically underprepared students with the skills they need to succeed in college and the labor market. Upon enrolling in college, however, students are often surprised to learn they need to take such courses, thereby illuminating an important disconnect between secondary (K-12) and postsecondary education. While many students and families believe that meeting high school graduation requirements will

adequately prepare them for college, in reality, students often need to take a more rigorous, demanding secondary school curriculum than that required by the district or state if they are to avoid remedial courses in college. A lack of alignment between the K-12 and postsecondary education systems frequently results in confusing messages to students and their parents about how and what students should do to be able to enter and succeed in college (Venezia, Kirst, & Antonio, 2003).

Far too many students graduate from high school underprepared for college-level work, and college readiness in math can often be the greatest obstacle to students' success. Although developmental courses may provide necessary support to some underprepared students, a growing body of evidence suggests that students placed in developmental education, particularly those placed in developmental math, are highly unlikely to obtain an associate degree or transfer (Bailey et al., 2010; Calcagno, Crosta, Bailey, & Jenkins, 2007; Fong et al., 2015). The identified cause resulting in consistent low persistence, and graduation rates is the widespread concern nationwide regarding low rates of college readiness among high school graduates. Some estimates suggest that only one-third of high school graduates finish ready for college work; the proportion is even lower among older students (Bettinger et al., 2013).

The majority of community college entrants will be referred to remediation in one or more subjects (Bailey et al., 2010). In fact, about half of all entering college take one or more remedial course and among those who take any, the average is 2.6 remedial courses (Chen, 2016). Other estimates have indicated that roughly 60% of community college students are referred to developmental math upon entry, a decision that could require a student to take a year or more of developmental courses before being able to

enroll in credit-bearing, college-level classes (Bailey et al., 2010). One of the primary explanations for college non-completion is that many entrants, despite having graduated from high school, nonetheless lack the basic academic skills required for success in college coursework (Baily et al., 2010).

The most recent ACT National Report revealed a continued decline in the percentage of American Indian students who are meeting ACT college readiness benchmarks. Since 2013, when 19% of American Indian students were prepared for college, the rate has slowly but surely changed in 2017 to 16% of American Indian students meeting college readiness benchmarks (ACT, 2017). In a recent press release, as cited in a recent press release, ACT Chief Executive Officer Marten Roorda said: " While it's no surprise that underserved students fall behind their peers due to the inequities that test, it is extremely alarming and concerning to see how large this achievement gap really is." "This gap presents a major risk to our nation's goal for postsecondary completion and economic competitiveness, Roorda, said (ACT, 2017).

What is Developmental Education

To accommodate an influx of diverse students, many decades ago universities began implementing open-enrollment policies at the junior college and university levels, giving all students opportunities to pursue higher education. However, this also placed a greater demand on educational services because many of the students did not receive either adequate academic preparation or even a formal education before enrollment (Conforti, Sanchez, & McClarty, 2014). Therefore, in the 1960s, universities established remedial and compensatory education services and collectively called them "developmental education" (Dotzler, 2003). Remediation is and always has referred to

the teaching of stand-alone courses teaching pre-college material. Developmental education, on the other hand, is known by professionals in the field is the integration of courses and services governed by the principles of adult learning and development (Boylan & Bonham, 2014).

Remedial, basic skills or developmental education is defined as, "foundational skills in mathematics and English deemed necessary for students to be successful in college-level work" (Boatman & Long, 2017). Traditionally, developmental education has intended to address whatever was missed in high school (Boatman & Long, 2013). Participation in developmental education is also more common among several demographic groups, including black

enrolled in a developmental course between 2010 and 2014. Still, despite differences between particular groups of students, developmental education overall is widespread, affecting both disadvantaged and advantaged populations.

Assessment or Placement Tests

The majority of the public two-year colleges across the nation use either ACCUPLACER or COMPASS. These are computer-adaptive placement tests that identify student skills in Arithmetic, Algebra, and College-Level Math using an algorithm that responds to student performance (Mattern & Packman, 2009). The computer-adaptive format adjusts the question level based on students' patterns of answers. In effect, it produces a single measure of students' math skills. But computer tests are not the only option for placement testing. ACT phased out COMPASS in 2016.

Colleges use one of the two popular computer-adaptive tests or the Mathematics Diagnostic Testing Project (MDTP), a diagnostic test aimed at assessing student

proficiency on a range of topics, which instructors can theoretically use to inform their classroom instruction. Another purpose of the diagnostic test is to inform placement decisions. Researchers looked at what happened after two colleges switched from using the MDTP to using a computer-adaptive test. They examined placement accuracy and whether students persisted through their placed course and passed it successfully within one-year. They found the following: Students placed using results from computer-adaptive tests were more negatively impacted by the placement decision than prior cohorts placed by MDTP, they were less likely to enroll and persist onto the next math course after the placement test switch. Consistent with other studies, diagnostic tests can provide information on student proficiency on a range of subtopics such as fractions, exponents, and reasoning which can improve math placement decisions and/or tailor instruction in math courses.

Progression in Developmental Math

Because students most commonly have to succeed in their assigned developmental course before moving on to the next course in the sequence, developmental courses are often the "gateway" to college-level courses. More campuses nationally restrict enrollment in some college-level classes until remediation is complete, and most require students placed into remediation to enroll in the course recommended by the institution (Butrymowicz, 2017).

Students in need of multiple remedial courses in the same subject could thus take courses for more than a year before fulfilling their remedial requirements. Not surprisingly, in our study, as has been identified in other studies previously, students assigned first to the higher developmental mathematics courses complete their

developmental course sequence and move on to a college-level mathematics course at higher rates than those assigned to the lowest-level courses. In colleges that offer two levels of remedial math, 28% of the students were referred to the lowest-level course (Parker, Bustillos & Behringer, 2010). Rates are even lower for men, older students, African American students, part-time students, and students in vocational programs (Bailey et al., 2010). Because remedial courses rarely count toward a student's graduation requirements, remediation may decrease rates of degree completion. The largest barrier for developmental student progression is attempting their initial course (Fong et al., 2015). The higher that students start in their math trajectory, the more likely that they successfully completed. Across levels, most students exit the sequence by not attempting or not passing their initial course.

Edgecombe stated that "mounting evidence suggests that the traditional sequence of developmental education courses hindered community college students from entering college-level coursework and ultimately earning a credential" (p. 1). The study, which used 2010 data from participants in Achieving the Dream, found that only 33% of students referred to any level of developmental math completed their course sequence within three years (Edgecombe, 2011). Only 17% of students who place in the lowest levels of developmental math complete their sequence.

When a student decides not to persist at a particular institution not only is the individual student affected, but the institution is also impacted by the loss. A thorough understanding of all factors related to student persistence is necessary for individual student success and institutional effectiveness. Student retention and persistence continues to be a growing issue on college campuses. Even with a strong student-focused

environment, a major challenge for TCUs is to meet or exceed their goals for student persistence, retention, and subsequent graduation.

Challenges Surrounding Assessment

Students assigned to developmental courses are deemed academically weaker than students assigned to college-level courses, and they graduate at lower rates than do students deemed college-ready (Bailey et al., 2009). But a lack of skill is not the only reason developmental students do not fare well in college. Research has found that traditional developmental education can hinder students in a variety of ways that could be improved through better policy and practice, such as placement instruments and processes (Hodara, Jaggars, & Karp, 2012).

Student performance on standardized placement exams is weakly correlated with success in college-level courses; consequently, when colleges use these exams as the sole instrument of placement, a large proportion of students may be placed into courses for which they are underprepared or over-prepared (Belfield & Crosta, 2012; Scott-Clayton, 2012). The tests' poor predictive capability may be due to a number of factors, each of which represents a specific limitation of the typical assessment process. These include: (1) a lack of student preparation for the tests and understanding of the process, (2) a misalignment between the test content and academic curriculum and standards in college courses, and (3) the use of a single measure for placement.

First, many students are unaware of the purpose and consequences of placement exams (Grubb, 2011; Venezia, Bracco, & Nodine, 2019). Open-access colleges may be reluctant to stress the high-stakes nature of the exams for fear that students will misinterpret them as admission exams (like the ACT or SAT used at more-selective

colleges). Students may be told that they cannot fail the exam, or that the exam is intended only to match them to the best possible courses. It is not surprising, then, that some students do not prepare for the exams or even set aside adequate time to complete them. Such students may have the potential to do well in a college-level course, yet perform poorly on the relevant placement exam.

Second, standardized exams may have low validity because they are poorly aligned with the academic standards and expectations of college-level coursework. For example, math placement exams are typically designed to determine whether students are prepared for a college-level algebra course (Hughes & Scott-Clayton, 2011). Yet a liberal-arts student may be able to fulfill her college-level math requirement with a quantitative reasoning course, which does not require the same set of foundational concepts as college-level algebra (Cullinane & Treisman, 2010). As a result, even if the student prepared properly for the math exam and set aside sufficient time to complete it, her score on the exam may be a poor indicator of how well she would perform in her college-level math course. Another limitation is using single measures for placement is the inability of such measures to distinguish different student needs for remediation. Students differ in their comfort and mathematical concepts, their exposure to math in high school, their ability to interpret test questions given their English language proficiency, and the same time since their last math course (Bailey & Cho, 2010).

Third, a single score on a test of academic proficiency provides only a partial indication of a student's degree of readiness for college coursework (Conley, 2010). Non-cognitive measures may be stronger predictors of course success. In particular, high school grade point average (GPA) is a better predictor than standardized placement exam

scores of students' success in college-level math and English (Belfield & Crosta, 2012; Scott-Clayton, 2012), as well as a much stronger predictor of college graduation than SAT and ACT scores. This superior predictive power suggests that GPA signals far more than just math or writing proficiency; it is also a measure of student's motivation and perseverance (Belfield & Crosta, 2012). A more comprehensive and, perhaps, accurate assessment and placement process would determine students' college readiness in the areas of cognitive strategies, academic behaviors, and attitudes, and "college knowledge," domains that may be just as important for college success as academic proficiency in English and math (Conley, 2010; Karp & Bork, 2012).

Limitations with Current Practices

An accurate placement mechanism will direct students who are college-ready into college-level coursework while referring students who are academically underprepared for developmental coursework. Of community college students who enroll in developmental coursework, just 28% earn a degree within eight years, compared with 43% of those who did not take any developmental coursework (Attewell et al., 2006). While these differences in outcomes could be attributed to differences in academic capabilities, a number of studies have employed a regression-discontinuity approach to compare similar students with placement test scores just above and below the cutoff and found that developmental enrollment has null or negative effects on short- and long-term outcomes (Bailey et al., 2015). A null impact on completion would indicate that students who score just below the cutoff and are referred to developmental education earn credentials at roughly the same rates as similar students who enter directly into college-level coursework. Thus, the introduction of pre-degree coursework does not improve

college completion rates, but rather extends the time required to earn a credential and increases the cost to students (Crisp & Delgado, 2014; Scott-Clayton & Rodriguez, 2012).

Moreover, scores on entry assessments are not highly correlated with success in initial college-level courses. When used as the sole measure for course placement, these tests incorrectly place many incoming students (Bailey et al., 2015; Belfield & Crosta, 2012; Scott-Clayton, Crosta, & Belfield, 2014). For example, using data from a community college system in a large urban setting, Scott-Clayton (2012) demonstrated that high school grade point average (GPA) explained a greater share of variation in outcomes for gatekeeper math courses than placement test scores. A combination of placement test scores and high school achievement measures yielded the greatest explanation of variance. Another limitation of using single measures for placement is the inability of such measures to distinguish different student needs for remediation. Students differ in their comfort with mathematical concepts, their exposure to math in high school, their ability to interpret test questions given their English language proficiency, and the time since their last math course (Bailey & Cho, 2010).

Effectiveness of Developmental Education

The goals of the developmental education process are threefold: to ensure that students are successful in their first college-level courses, to provide students with the additional preparation needed to succeed in later courses; and to enable institutions to maintain standards of academic quality and rigor in college courses. But, research has challenged the notion that the traditional developmental education process improves students' long-term academic success, given that the majority of students who enroll in

remedial courses never complete their requirements, much less move on to college-level coursework (Bailey et al., 2010). As researchers and practitioners work to clarify the problems with the current system and test potential solutions, many have focused on improving the developmental curriculum or course pedagogy (e.g., Edgecombe, 2011; Hodara, 2011; Perin, 2011), while others have examined the assessment process itself (e.g., Hughes & Scott-Clayton, 2011; Venezia, Bracco, & Nodine, 2010).

Student performance on standardized placement exams is weakly correlated with success in college-level courses; consequently, when colleges use these exams as the sole instrument of placement, a large proportion of students may be placed into courses for which they are underprepared or over-prepared (Belfield & Crosta, 2012; Scott-Clayton, 2012). The tests' poor predictive validity may be due to a number of factors, each of which represents a specific limitation of the typical assessment process. These include: (1) a lack of student preparation for the tests and understanding of the process, (2) a misalignment between the test content and academic curriculum and standards in college courses, and (3) the use of a single measure for placement.

First, many students are unaware of the purpose and consequences of the placement exam (Grubb, 2011). Qualitative research has documented that students are often uninformed about the significance of placement tests (Venezia et al., 2010) and that administrators face trade-offs between efficiency and effectiveness when deciding upon placement policies (Jaggars & Hodara, 2011). Colleges admit that many, if not most students, take placements tests without understanding their purpose or high-stakes nature (Safran & Visher, 2010). Interviews with community college students have found that

they were unprepared for the content and format of the tests, that they were still confused to discuss their results and subsequent course-taking options (Venezia at el., 2010).

Open-access colleges may be reluctant to stress the high-stakes nature of the exams for fear that students will misinterpret them as admission exams (like the ACT or SAT used at more-selective colleges) (Hodara at el., 2012). Students are told in many instances, from my experiences, that they cannot fail the exam, or that the exam is intended only to match them to the best possible courses (Hodara at el., 2012). It is not surprising, then, that some students do not prepare for the exams or even set aside adequate time to complete them. Such students may have the potential to do well in a college-level course, yet perform poorly on the relevant placement exam (Hodara at el., 2012).

Second, standardized exams may have low validity because they are poorly aligned with the academic standards and expectations of college-level coursework. For example, math placement exams are typically designed to determine whether students are prepared for a college-level algebra course (Hughes & Scott-Clayton, 2011). Yet a liberal-arts student may be able to fulfill her college-level math requirement with a quantitative reasoning course, which does not require the same set of foundational concepts as college-level algebra (Cullinane & Treisman, 2010). As a result, even if the student prepared properly for the math exam and set aside sufficient time to complete it, her score on the exam may be a poor indicator of how well she would perform in her college-level math course.

Third, a single score on a test of academic proficiency provides only a partial indication of a student's degree of readiness for college coursework (Conley, 2010).

Non- cognitive measures may be stronger predictors of course success. In particular, high school grade point average (GPA) is a better predictor than standardized placement exam scores of students' success in college-level math and English (Belfield & Crosta, 2012; Scott-Clayton, 2012), as well as a much stronger predictor of college graduation than SAT and ACT scores. This superior predictive power suggests that GPA signals far more than just math or writing proficiency; it is also a measure of student's motivation and perseverance.

A more comprehensive and, perhaps, accurate assessment and placement process would determine students' college readiness in the areas of cognitive strategies, academic behaviors, and attitudes, and "college knowledge," domains that may be just as important for college success as academic proficiency in English and math (Conley, 2010). There are a variety of studies that stand-alone remedial courses are often ineffective for many students (Boatman & Long, 2010; Complete College America, 2012). As a result of students placed in these courses using marginally accurate assessment instruments and questionable placement scores (Hughes & Scott Clayton, 2011). Furthermore, students are typically uninformed about the consequences of placement test scores and unprepared to perform well (Hodura, Smith Jaggers, Mechur, & Karp, 2012). As a result, developmental education becomes a terminal barrier for many students.

The extensive research on developmental assessment has identified many challenges with the typical assessment process. In spite of the significant investment in developmental education, and the well-intended interests of those that support or detract the effectiveness of development education, and founded on studies that consistently

draw generalization based on a single institution's data, it remains that effectiveness has never been clearly established, especially for the weakest students (Handel & Williams, 2011). Understanding how students actually progress through their college programs is essential in developing strategies and choosing appropriate interventions to improve student outcomes.

Assessment and Placement Studies

Recent research has focused greater attention on the placement testing process by which students are assigned to remedial courses. Using New York Community college data, Belfield, Jenkins, and Crosta (2014) conducted a study of the validity of high school data and placement tests for predicting college course grades. Belfield, Jenkins, and Crosta (2014) found that "placement tests do not yield strong predictions of how students will perform in college" (p. ii). According to Belfield and Crosta (2012), the accuracy of placement tests has severe error rates using cut-off test scores. The error rate for English was three out of ten students misassigned; math error rates are lower (Belfield & Crosta, 2012). Belfield, Jenkins, and Crosta (2014) found that "using high school GPA instead of placements tests reduces the error rates by half across English and math" (p. ii).

The use of the new placement test by the Virginia Community College System Office has shown promise for reducing the number of students placed in developmental education and for increasing the number of students completing college math (Rodríguez, 2014). In fall 2012, Rodriguez (2014) found a 24% higher placement rate into college math for first-time, first-year students using the customized placement test as compared with peers who used the COMPASS placement exam in the fall of 2010.

The percentage of students who placed into and completed college math grew by 10% as the fall 2012 cohort progressed. (Rodríguez, 2014).

Using placement tests to place students in developmental or college-level courses appropriately is an area of concern for community college leaders. One challenge to community colleges has been the student's varied characteristics made predicting success in community college courses more difficult (Armstrong, 2000). Armstrong added that "sorting students by using cutoff scores on a test may mask important individual student characteristics and situations" (p. 682). As researchers and practitioners work to clarify the problems with the current system and test potential solutions, many have focused on improving the developmental curriculum or course pedagogy (Edgecombe, 2011, Hodara, 2011, & Perin, 2011), while others have examined the assessment process itself (Hughes & Scott-Clayton, 2010).

The limited impact of assignment to remediation may be due to the fact that some students are misclassified by the testing process as needing remediation (Scott-Clayton et al., 2014). Students who are college-ready but assigned to remediation incur unnecessary extra tuition and time costs and progress more slowly toward completion; they are likely to be discouraged by their experiences, without any corresponding gains in credits earned or degrees completed. Conversely, assigning unprepared students to college-level coursework generates a different set of potential. We are careful to draw a distinction here between the impact of assignment on remediation and the impact of actually completing a remedial course.

The studies cited here focus on the former since it is the margin over which policymakers have direct control. These students are much more likely to drop out and

lose their investment of time and money in a college education, which they might have completed if they had first taken remedial courses (Boatman & Long, 2010). Also, underprepared students in college-level courses may impose negative peer effects on students who are ready for college-level work (Carrell, Fullerton, & West, 2009). Hence, recent research has focused greater attention on the placement testing process by which students are assigned to remedial courses.

While placement testing itself is ubiquitous at community colleges, there is variation in the types of tests that are used, the rules for exemption, and the cutoff scores for college-level placement; it is not always clear what drives differences in these policies from institution to institution (Fields & Parsad, 2012; Hughes & Scott-Clayton, 2010). Qualitative research has documented that students are often uninformed about the significance of placement tests (Venezia et al., 2010) and that administrators face trade-offs between efficiency and effectiveness when deciding upon placement testing policies (Jaggars & Hodara, 2011). Scott-Clayton et al. (2014) highlight the imperfect accuracy of test-based placement decisions. Using detailed information on test scores and high school performance, they estimate that roughly one-quarter of test-takers in math is severely misassigned (either to college-level courses when they are predicted to fail or to remedial coursework when predicted to do well without it). Scott-Clayton et al. found that in many cases, the placement tests add little predictive value beyond that which could be obtained from using high school performance measures (grades and units completed by subject) alone. Another recent study found that increasing access to college-level math courses via the introduction of a new placement test and placement policy resulted in significant increases in the number of test-takers successfully completing college-level math; under

the prior placement policy, a substantial number of these test-takers would have been assigned to remedial math (Rodríguez, 2014). It is possible that if colleges devoted more resources to their systems for remedial assignments, they could improve the accuracy of placement.

Traditional Models of the Delivery of Developmental Math

Until about 2012, there was no particular legislative attention being paid to the remedial course (Boylan, Brown, & Anthony, 2017). There were, however, some reports suggesting that the remedial course was not working well (Bailey, Jeong, and Cho, 2011; Martorell & McFarlin, 2011). Even more influential was a report by Complete College America entitled, "Remediation: Higher Educations' Bridge to Nowhere" (2012). This report claimed that remedial courses were a dead-end because few students passed them and even those who did rarely passed the college-level courses in that subject. Faced with the evidence, policymakers, administrators, and researchers began calling for a change in developmental education policies and practices (Bettinger, Boatman, & Long, 2013). One of the main efforts to reverse low success rates among remediated students involves changing the way community college structure or teach or deliver, developmental education (Rutschow & Schneider, 2011). Postsecondary institutions across the country offer developmental courses structured in a variety of ways. The traditional developmental course generally takes a fifteen-week, semester-long format. Courses are typically, but not universally offered for credit, but don't count towards a graduation requirement. The vast majority of colleges offer multiple levels of developmental courses within a subject area (Butrymowicz, 2017).

Developmental math has been traditionally delivered as a sequence of courses that resemble a high school math progression focused on teaching algebraic content. Researchers find that being placed into a traditional developmental math sequence may predispose students to academic failure in two ways (Grubb, 1999). Community colleges across the United States are developing new or alternative models of delivery to address the perceived flaws of traditionally delivered developmental education by reducing potential exit points and the amount of time spent in development education (Kosiewicz, Ngo, Fong, 2016).

First, placement into developmental math inherently increases the amount of time and money a student must spend in college to earn a degree or transfer, which may dissuade some from enrolling in or persisting through college (Hanford, 2016). Second, traditional models of delivery, which are typically lecture-based, often employ remedial pedagogies that focus on drills and sub-skills and that are disconnected from other courses and real-world applications; these approaches may not adequately respond to the academic needs and behaviors of remediated students (Grubb, 1999). Traditional as a series of lecture-based, semester-long courses, research suggests that developmental education increases the amount of time a student must spend in school and the possibility that a student will drop out in between semesters, resulting in a situation ripe for non-completion (Bailey, 2009; Melguizo et al., 2008).

In response to legislative mandates, some community colleges have started to employ alternative models to deliver developmental education. Each alternative model or approach uses a different strategy to address the perceived flaws of the traditional delivery model, and falls under four broad categories (a) helping students shore up skills

prior to entering college; (b) providing supplemental instruction, such as tutoring and advising; (c) reducing the number of time students spend in developmental education; and (d) redesigning curriculum and learning.

However, there is a concern that the lowest developmental students would not benefit from an accelerated program; the lowest-achieving students would have performed better in a traditional semester-by-semester sequence of remedial courses (Jaggars et al., 2015). "Overall, we find that accelerated developmental education provided students with a strong positive boost regarding their probability of enrolling in and completing college-level math and English" (Jaggars et al., 2015, p. 20). To have maintained successfully accelerated pathways, colleges needed to incorporate rigorous content provided systematic faculty development and enlisted targeted student supports (Jaggars et al., 2015).

Reducing the Amount of Time in Developmental Education

Alternative models of delivery that reduce the number of time students spend in remediation directly address the potential negative consequences of long multicourse sequences (Kosiewicz, Ngo, & Fong, 2016). Students with the most remedial requirements to complete are the least likely to persist (Kosiewicz, Ngo, & Fong, 2016), and extending the amount of time in remediation has been found to decrease semester-to-semester persistence. The existence of “exit points” separating courses in developmental education sequences has also been a point of concern because each one gives students a way out of each sequence.

Acceleration, compression, and modularization models are three alternative delivery approaches designed to shorten the amount of time spent in developmental

education and make the sequence more seamless. The majority of developmental students drop out of college before completing their developmental course sequence due to a failed course, or because they cannot enroll in the next course in the sequence due to lack of course offerings (Bailey et al., 2015; Scott-Clayton & Rodriguez, 2012). Due to high attrition rates, colleges have experimented with accelerated curriculum structures wherein student's complete remedial courses sooner (Bailey et al., 2015). "The traditional sequence of developmental courses undermined academic achievement in part because it has a multitude of exit points (Edgecombe & Columbia University, 2011, p. 1). Students chose never to enroll or dropped out between courses in the sequence (Bailey & Jaggars, 2016; Bailey et al., 2015; Edgecombe, 2011). Consequently, the lack of sequence success led many practitioners to experiment with restructuring the developmental math sequence of courses (Bailey et al., 2015; Edgecombe, 2011).

Acceleration models. Typically combine developmental courses to reduce the number of courses a student must complete enrolling in college-level courses (Hern, 2012). Acceleration of developmental math courses involved reorganizing the curricula in ways that expedited the completion of coursework (Edgecombe, 2011). Acceleration of remedial coursework reduces exit points and matches learning outcomes with college-level courses (Bailey et al., 2015). Within the tribal college setting, about one in five students entering a tribal college hold a GED and are more likely to place into remedial courses (Gonzalez, 2012). One tactic that TCUs are finding effective for these students to finish their coursework is accelerated learning. "When people come in for a one-year program, they actually want to finish it in one year," says Karen Cary, chair of the department of professional studies at Leech Lake (Gonzalez, 2012).

Modularization models. Another approach to redesigning developmental education curriculum is to "modularize" the content, which involves, for instance, taking a semester-long develop-mental course and dividing it up into distinct modules that address specific competencies or skills (Nodine et al., 2013). Through this modularization approach, diagnostic placement tests are used to determine the specific areas in which a student needs additional support to be ready for college-level courses. In modularization, students are required to focus only on those identified areas in which they need additional support through customized intervention modules targeted to address the specific competencies or skills that they need to improve and not on content areas that they have already mastered. Modularization is one way to provide a more targeted approach to developmental education that focuses on students' needs and enables them to get through the necessary developmental curriculum more quickly.

There is some evidence from other states on the effectiveness of these instructional strategies. In North Carolina and Virginia, for example, both states implemented multiple one-unit math modules in which students enroll based on their specific math needs Edgecombe, 2016). Modular and contextualized courses still typically require that students enroll in at least one semester of developmental education coursework before enrolling in the gateway course. Findings from evaluations of these models are mixed, in part because of the way these evaluations were conducted. Correlational studies show that students in the California Acceleration Project were more than twice as likely to complete college-level courses than their peers (Hern, 2012). Two other studies found that modularized developmental education at Jackson State University in Tennessee was positively associated with passing rates, improved learning

outcomes, and increased retention in and completion of developmental math (Epper & Baker, 2009).

Yet, causal methods studies paint a more complex picture. Using both difference-in-difference and regression discontinuity approaches, Boatman (2012) found that Tennessee students in accelerated courses (at Cleveland State Community College) and modularized developmental math courses (at Jackson State University) completed more units but failed to persist at the same rate as their traditional counterparts.

Compression model. One potential approach to redesigning developmental education curriculum is to compress curricular sequences, eliminating some of the layers of develop-mental education previously required. For instance, where a student might previously have been designated as needing two semesters of developmental math, a new course might be designed to fit that content into one semester, thus accelerating the student's path into credit-bearing courses. Research (Hern, 2010) has indicated that the more exit points a student has between enrolling in developmental education and subsequent credit-bearing courses, the more likely they are to drop out. The accelerated semester thus gives students one less chance to exit the system. Hodara and Jaggars (2012) used matching methods and found that students in compression programs in the City University of New York were more likely to pass college math and complete their degrees, yet obtained the same number of credits as traditional developmental education students. Based on this range of results, the true effects of acceleration, compression, and modularization models remain unclear.

Redesigning Curriculum and Learning

Alternative models of delivery that redesign curriculum in developmental education inherently change curricular content and how students learn developmental education. This approach is founded on the idea that pedagogical practices and curricula promoting reasoning skills, conceptual understanding, and real-world applications, more so than procedural knowledge, are key to increasing student success (American Mathematical Association, 2018).

Statway, a program developed by the Carnegie Foundation for the Advancement of Teaching, is perhaps one of the best known types of curricular redesign in developmental math, and is built on the belief that mastery of statistical concepts yields more academic benefits to students pursuing non–Science, Technology, Engineering, and Mathematics (STEM) fields of study (Cullinane & Treisman, 2010). Other forms of developmental education redesign we discuss are learning communities, co-requisite courses, and guided pathways (Belfield, Jenkins, & Lahr, 2016; Rutschow & Schneider, 2011).

Learning Communities. Require students to enroll in developmental education courses as cohorts and engage in collaborative learning experiences with a core group of professors and peers. This approach is founded on the belief that meaningful interactions between students and faculty can improve communication and content understanding, and thus student success (Tinto, 1997).

These models address the unstructured nature of community college academic programs by encouraging colleges to define learning outcomes and align curricular experiences and support services with students' specific college and career goals (Bailey

et al., 2015). Although some of these reforms are gaining traction, the evidence on their effectiveness remains limited. (Smith, 2016).

In 2011, Manpower Demonstration Research Corporation (MDRC) did a review of studies on remedial education delivery and found: "Programs that show the greatest benefits with relatively rigorous documentation either mainstream developmental students into college-level courses with additional supports, provide modularized or compressed courses to allow remedial students to more quickly complete their developmental work, or offer contextualized remedial education within occupational and vocational programs. Despite the insistence that the delivery of developmental education must be reformed to better meet the needs of students, recent research focuses almost exclusively on reform initiatives encouraged by state legislation or spearheaded by philanthropic organizations whose intent is to expand and test the effectiveness of particular alternative delivery models (Rutschow & Schneider, 2011).

Conceptual Models

` **Three-Legged Stool Conceptual Model.** A new conceptual model aimed at increasing gateway math course completion is best represented as a three-legged stool, as a way to visualize the relationship of the components (Mireles, Acee, & Gerber, 2014). The seat was the gateway or college-level math course, and the legs of the stool that support the seat were developmental mathematics, learning support, and academic support services (Mireles et al., 2014). A novel aspect of the new model was the inclusion of learning support, real-world problems, hot topics, and question and answer sessions (Mireles et al., 2014). The learning supports helped to better contextualize college-level mathematics (Mireles et al., 2014). Students who placed into developmental mathematics

and concurrently enrolled in college-level algebra made statistically significant improvements in their mathematics proficiency (Mireles et al., 2014).

These aforementioned student success strategies have helped to increase overall fall to fall retention rates of students (Bailey, 2015). Even students with the lowest test scores on placement tests have been successful in the co-enrolled model, but these lower-performing students are reported to have had strong academic support while they took college-level coursework (Jaggars, 2015). Several other different models currently exist, including fast-track courses, which compress the developmental education course curriculum into several weeks or a half-semester; self-paced, or modularized, courses, which break apart semester-long developmental education classes into smaller, competency-based units. Non-experimental research on each program type has shown higher pass rates in remedial and subsequent college-level courses (both in math and in writing), as well as higher rates of student persistence. Reforms with clear placement and assessment policies have improved students' college readiness through clearer communicated policies, and communicate expectations that students must achieve (Scott-Clayton & Rodriguez, 2012).

Developmental Education Reforms

States and institutions are using several different models to reform their developmental education programs. The different approaches to these reforms depend, in part, on the subject matter (mathematics or English), the local context, and the particular needs of the student population (Bracco, Austin, Bugler, & Finkelstein, 2015). For instance, the reforms may address the design of the developmental courses, when and

where the developmental courses are offered, or how students are determined to be "ready" for credit-bearing coursework.

To address the challenge of large numbers of students being placed into developmental education and not enough moving on and succeeding in subsequent credit-bearing courses, several of the Core to College states have undertaken statewide efforts to redesign their developmental education programs. This brief describes one of these particular efforts and identifies some of the key lessons learned from these efforts to date.

Colorado. Colorado Community College System (CCCS), comprising 13 institutions, is currently redesigning its developmental education program (CCCS, 2013). In Colorado, as in many other states, a number of students who start developmental courses fail to complete a college degree. The goal of redesigning the CCCS program and curriculum is to "accelerate students by reducing the amount of time, the number of developmental credits, and the number of courses in the developmental sequence so students can be successful in a college-level course" (CCCS, 2013).

A cross-institution developmental education task force spent 18 months studying approaches in other states as well as exemplary programs within the state. Drawing on successful examples across the country, In February 2013, the task force designed a new set of common English and mathematics developmental education courses, using backward design principles, based on what students need to know on their first day of a credit-bearing course. The aim was to get students into 100-level (entry-level) classes no later than their second term of college enrollment. For mathematics, the task force identified three different potential pathways for students (non-transfer, non-algebra transfer, and algebra) depending on their ultimate career goal or major area of interest,

and created separate developmental courses for these different pathways. As of fall 2014, only these newly designed common courses were offered for those students requiring developmental education in all of Colorado's community colleges.

Multiple Measures for Placement Decisions

Another way that states are reforming developmental education is by examining and updating the policies for how students are placed into developmental courses in the first place. Placement into college-level courses, particularly at the community college level, has traditionally been based on the results of standardized test scores alone. However, recent research has shown that standardized tests may not be the most accurate measure for placing students into credit-bearing courses, particularly when used as the sole measure for placement, and often result in "severe error" in which students are placed into developmental education when they could actually succeed in the college-level course (Belfield & Crosta, 2012; Scott-Clayton, 2012).

Researchers have identified the use of [multiple measures] as a way to increase placement accuracy, and have suggested that using multiple measures to inform placement decisions may more comprehensively support the transition from high school to entry-level, credit-bearing college coursework. Common multiple measures include, but are not limited to, additional test scores from alternate assessments, high school grade point average (GPA), high school grades in specific classes, life experiences, and counselor input and referrals (Bracco, Austin, Bugler, & Finkelstein, 2015). Many states and institutions are experimenting with the use of multiple measures to inform placement decisions in an attempt to identify more students who might be ready for college-level courses than would be indicated by their scores on a single standardized test alone

(Bracco et al., 2015). Another limitation is using single measures for placement is the inability of such measures to distinguish different student needs for remediation.

Preparing Students for the Process

Colleges worked to prepare students for the placement exams at two different points. While a small but growing number focused on students who were taking the exam for the first time, most focused on students who were re-taking the exam after an initial failure. For first-time test-takers, the majority of colleges provided links to sample tests on their websites to help students prepare for the placement exams, but only a handful had any systematic practice in place to direct students to these online materials or other test-prep resources. The exception was a few technical colleges in Georgia that required entering students to sign contracts prior to testing stating that they were informed about the test, its purpose, and what they could do to prepare. These colleges also provided free tutoring to help entering students prepare for the test.

Overall, implementing a placement test review seems to improve placement accuracy, in that it increases student access to college-level coursework without harming their academic success. For example, the descriptive findings from the North Carolina college show that from fall 2010 to spring 2011, among all students who took the review course before re-testing, about 60% tested at least one level higher in the developmental reading and English sequence than they had previously tested, and about 35% of students tested at least one level higher in the developmental math sequence. Additionally, these students had similar or higher pass rates in the courses they retested into, compared with their counterparts who placed directly into the course.

In contrast to the rareness of first-time test-prep resources, all colleges that allowed re-testing directed students to online review materials, and some offered "brush-up" or "refresher" courses prior to re-testing. Perhaps the most systematic and comprehensive re-test review was created by a North Carolina community college. Their review was initially designed as a set of face-to-face review sessions, which was required prior to re-testing among students who placed into two or more developmental courses. The success of this practice convinced college leaders that the review and the opportunity for re-test should be offered to all students who placed into developmental education.

Summary

Developmental education remains an area wide open for further research and innovation. Given the alarmingly low success rates for developmental students, these programs can no longer afford not to react. The current research demonstrates that minor modifications in developmental education programs are insufficient for producing dramatic improvements in student achievement. Educators, policymakers, and researchers, however, have an opportunity to build on what has been learned about promising interventions in order to develop and evaluate innovative efforts aimed at transforming the educational experience of academically underprepared students. As the field advances, it will become increasingly important to replicate these early results using more rigorous and reliable methods whenever possible. In addition, to be successful on a wide scale, new reforms in developmental education need to address two institutional issues at the core of policy and practice.

CHAPTER III

METHODOLOGY

Chapter three presents the research questions and hypotheses, population and sample data, data sources, a description of the transcripts and variables that were analyzed, and the data analysis procedures used.

Introduction

The purpose of the study is to understand if there is a difference in student persistence and outcomes based on their placement to either developmental or college-level math. For this study, a quantitative research design is used to conduct an examination of the progression of students enrolled at a tribal community college from initial placement in developmental math [remedial course] or assignment to the first college-level math course. The study focus is developmental mathematics courses, which in general have the highest rates of failure and non-completion of any developmental subject area (Bonham & Boylan, 2012). Consider that 68% of college and 40% of university students took a remedial course (U.S. Department of Education [USDOE], 2017). Once enrolled, only 50% of college students and 40% of university student's complete developmental education courses within 6 years of first enrolling (Chen & Simone, 2016). The discussion is broadened by moving beyond consideration of the developmental course and focus attention to include the developmental math sequence. A sequence is defined as a process that begins with the initial assessment and referral to remediation and ends with completion of the highest level developmental course (Bailey

et al., 2010). The same course that upon completion, the student is ready for college-level math coursework. The study tracks students as they progressed or failed to progress through their referred sequences of developmental course and analyzing those points at which they exit the sequence.

The goal is to gain insight into why these students are unlikely to go on to complete the first college-level math course and in addition, why these students are unlikely to go on to complete an education credential. With the newly acquired understanding, to serve data-driven research be used to make well-informed transformations in design processes and policies for the institution in this study.

The goals of this study were to ascertain answers to the following questions:

Research Questions

The research questions that frame this study are as follows:

1. Is there a difference in students completing the first corresponding college-level math course in three years for those placed in developmental math courses versus those not placed?

The hypothesis (H_0) is that there will be a difference given the majority of students who enroll in developmental coursework seldom complete the corresponding college-level course requirements.

The rationale for the hypothesis is the common concern in that placing students into multi-semester, non-credit remedial course sequences as a pre-requisite to enrollment in college-level math results in most students leaving the system and never making it to a college gateway course (Bailey, 2015; Vandal & Complete College, 2014).

2. Is there a difference in student's persistence when completing the math sequence in three years, for students placed in a developmental math course versus those not?

The hypothesis (H_0) is that there will be a difference between students with remedial requirements to complete, in that they persist lower than students with college-level requirements to complete.

The rationale for the hypothesis is students who are often assigned to a sequence of developmental math courses comprising of one or even more levels below the gateway-level math have lower persistence rates than students placed in the college-level math. Bailey, Jeong, & Cho (2010) found that only 20% of students referred to developmental math ultimately completed their course sequence.

3. Is there a difference in students earning an educational credential in three years of those placed in developmental math coursework versus those not?

The hypothesis is (H_0) that there will be a difference in the outcome for student because enrollment in developmental education delays time to degree and that these students are less likely to graduate than non-remedial students.

The rationale for the hypothesis is the common concern in that the majority of students placed in developmental courses following the assessment and placement process do not progress through course sequences to complete college-level courses or earn postsecondary credentials (Bailey et al., 2010; Fong et al., 2015).

Study Design

For this study, a quantitative research design was used to conduct an examination of the possible association between were from student's transcripts and were analyzed to look for statistically significant differences in student's progression from initial

placement in developmental math [remedial course] to the first-college level math course for three years or until their eventual departure. The study focus is the mathematics courses, which in general have the highest rates of failure and non-completion of any developmental subject area (Bonham & Boylan, 2012). The goal is to gain insight into why these students are unlikely to go on to complete the first college-level or gateway level math courses and in addition, why these students are unlikely to go on to complete an educational credential. The sample (n=213) for this study included only students entering the institution for the first-time, full or part-time, degree seeking and enrolled in a developmental or college-level mathematics course. The sample of students were also enrolled either fall semester 2012, spring semester 2013, or fall semester 2013.

For this study, the researcher used a base framework as the standard model to report student's identification for and progression through developmental and credit-bearing math courses. The framework does not endorse a particular assessment cut score or look for students short-comings, instead, it simply requires that student records are identified, and students initially assigned to participate in developmental or college-level math coursework. Overall, the framework is intended to be applied to the sample of students who were identified and the tracked for three-years to examine student progression and outcome in mathematics across a certain timeframe.

Time Frame

Accordingly, the framework applies a three-year lookback period, and as a highly informative length of time considering the institution in the study is a two-year tribal community college. The time frame consists of students enrolled either fall semester 2012, spring semester 2013, or fall semester 2013, and tracked until fall 2016, or their

eventual departure. This time is intended to allow the framework to capture the academic progression of the students naturally (ECS, 2014). The purpose of this look back is to allow researchers and policymakers to view student outcomes over the first crucial 24 months and then beyond. The study included part-time students and developmental course sequences that may extend across multiple semesters. The framework is intended to focus attention on academic progression and outcomes.

Population

The parameters of the population for this study, were all students enrolled for the first-time either fall semester 2012, spring semester 2013, or fall semester2013. Summer terms were not included in the data collection unless the student was enrolled in a mathematics course. The population made up of 362 students. Subsequently, all the units of the population did not meet the criteria to be included in the study.

The students of this student attend an institution where there is no housing available on campus, and there were not provisions of daycare or transportation services. Most students have funding sources available to them, according to the institutions Financial Aid Director. The college offers GED services, tutoring, certificate programs, associate degrees, and associate of applied science degrees. Broadly, the population that makes up the institution, historically consists of more females than males, the average age is 30 years, >75% first-generation, financial aid eligible, and lives in historical poverty. On average, the institution retains 82% of its students fall to the spring semester. However, it loses 47% to 49% of these students at the completion of the spring semester. Typically, due to suspension for not making satisfactory academic progress. According to policy, these students are not allowed to register for the following semester following the

suspension and are required to submit an appeal to be readmitted. If the appeal is granted, the student is limited to registering for six-credits upon returning and is placed on continued academic probation.

Sample

The sample for this study to be analyzed (n=213) is made up of those students enrolled for the first-time, full or part-time, and degree-seeking, during either the fall semester 2012, spring semester 2013, or fall semester 2013. Omitted from being included in the representative sample where those employees of the institution, those students participating in a certificate programs, and finally omitted were the few who enrolled consecutive semesters but never enrolled in a math course at any level before their eventual departure.

Data Collection

For the quantitative analyses conducted for this study, one source of data was used, course transcript data. Following IRB approval from the University of North Dakota, the Registrar was given official notice to begin accumulating the approved transcripts for processing. Processing involves retrieving the transcripts, stripping each one of all identifying information, assign a unique identifier to each transcript, and then providing to the principal investigator.

This study involved the statistical analysis of data collected by the institution, or secondary data analysis. Longitudinal analysis of student enrollments and achievements required data on individual students. The records reviewed include data sets that were not collected with the intent to conduct research but instead exists for the purpose of collecting information on students in the form of student records. For the quantitative

analyses conducted for this study, one source of data was used, course transcript data. The records reviewed for this study were the individual student transcripts.

Course transcript data to be reviewed include: 1) individual transcripts for all students registered fall semester 2012, spring 2013, and fall 2013 to fall 2016. For this study, enrollment was tracked only in developmental and college-level mathematics courses. Summer terms were excluded from the study unless a student was enrolled in a math course. To identify developmental education and college-level courses in the dataset, the college catalog was reviewed to compile the course numbers and titles (see Table 1). Then each course was given a number and coded by its course number and course level, and to allow the researcher to track the student for the length of 3-years, individual transcripts to be reviewed will include the data necessary to contain one record per student, per semester for every semester the student enrolls. Each student record data set includes the following data fields: math courses subject, course level, courses attempted, and credits earned. In addition, term-by-term data elements on courses enrolled, such as letter grades earned, and any confirmation of an educational credential earned.

To identify developmental education and gatekeeper courses in the dataset, the college catalog was reviewed to compile the course numbers and titles. Then each course was given a number and coded by its course number and course level.

Table 1.

Math Course Descriptions

COURSE TITLE	COURSE DESCRIPTION	SEMESTER CREDITS
ASC 091 Applied Math	This course covers the fundamental skills in mathematics with basic arithmetic. Course content includes fractions, percent's, and decimals.	3
ASC 092 Basic Math	This course proceeds through to pre-algebra. Course content includes: number systems, basic terms of algebra and algebraic expressions.	3
MATH 102 Intermediate Algebra	This course is designed for the student who has limited Algebra knowledge. Topics include the real number system, exponents, roots, radicals, rational exponents, polynomials and rational expressions.	3
MATH 103	In this course the student will study triangle trigonometry, and applications of trigonometry.	3

The first gateway level math course, intermediate algebra, MATH 102, was coded 1. The intermediate level algebra course is one level below the highest gateway level algebra course, MATH 103, which was coded 0. The two levels of developmental math courses were coded 2 and 3 respectively. The highest level developmental math course, ASC 092, and also the last developmental course in the developmental math sequence was coded 2 and the first level developmental math course, ASC 091, coded 3.

Data Analysis

Inferential statistics were used to determine if an association existed between two variables. This was done through the chi-square statistic tables of the sample. The researcher looked at the contribution of the independent variables in explaining hypothesis test using 2x2 contingency tables. The normal significance level of 0.05 was applied for the hypothesis testing. The 0.05 level is accepted by most researchers in making statistical decisions.

Variables

Within the context of this study, the independent and dependent variables are those elements within the experience and output constructs of the framework. The input construct, an independent variable, but for the purposes of this particular study, gives the reader context and background for understanding. For their work to be understood at tribal community colleges, it is, for that reason, necessary to place the reader in the context of the communities in which they serve.

Input Construct

Input, for the purposes of this study, is the construct that provides a uniquely non-traditional and new student profile that gives context and background to this study relative to its effects on the student's experiences and output. Input is an independent variable and that there are numerous studies that define each of the variables and their relationship to student progression and academic achievement. In large part, the students in those studies exist from populations at traditional two-year community colleges, as opposed to the unique nontraditional populations that exist at two-year tribal community colleges.

From the beginning of the tribal college movement, TCUs have provided access to populations underrepresented in higher education. A minority population that statistics show a gap in higher education enrollment and achievement for these students. Coupled by the challenges of different life experiences, the majority of American Indian students are the first in their families to attend higher education, have dependents, and live in poverty (American Indian College Fund [AICF], 2011). First-generation students are a specific sub-population of the first-year student group that has deserved particular attention in this study; but for the reader to understand the work done at TCUs it also remains important to consider the backgrounds (Input) of students who are from reservations.

Theresa Pouley, chief judge of the Tulalip tribal Court in Washington, went on to list a number of other issues that affect those living on the reservation, "Their substance abuse rates are higher," she told the Washington Post. "They are twice as likely as any other race to die before the age of 24. They have a 2.3% higher rate of exposure to trauma. They have two times the rate of abuse and neglect. Their experience with post-traumatic stress disorder rivals the rates of returning veterans from Afghanistan." (Horwitz, 2014). Approximately one-third of Native Americans lives on Indian Reservation (Brayboy & Castagno, 2011). While this represents a decrease over the past few decades (Brayboy & Castagno, 2011), it remains important to consider the backgrounds of students who are coming from reservations. Unquestionably, the influence of these factors contributes to persistence and educational attainment, or lack of, among post-secondary Native American students attending tribal community colleges. Our goal in this study was to track these uniquely non-traditional students for three years

and analyze their progression from when they are initially placed in a developmental or college-level math course until they voluntarily or involuntarily depart the institution, with the intent to identify and eliminate barriers and to better define successful progression through the sequence.

Environment Construct

An independent variable is a variable in research that causes a change, or is presumed will cause a change, to the dependent variables in the research conducted. The environment constructs consist of two independent variables that include: placement in developmental math, or placement in college-level math. Placement in development math is being assigned to one of the two-levels of developmental math courses, ASC 091 or 092. Placement in college-level math is being assigned to one of the two-levels of college-level math courses, MATH 102 or 103. All math courses, with the exception of MATH 103, which is a 4-credit course, are 3-credit, semester-length courses.

Aside from being placed in one of the developmental math courses, students placed in MATH 102, intermediate algebra, have to also complete MATH 103, college algebra course to have fulfilled the college-level math requirement for graduation or transfer. Students placed in MATH 103, successfully completing are eligible for graduation and/or transfer in one semester as opposed to two semesters. Transfer to any four-year institution to obtain a bachelor's degree will require the student to eventually complete a college-level algebra math course either here or there. In North Dakota, the university system has deemed MATH 103 across the board, in the terms of common core, the college-level math course that upon successful completion assures the accreditation

body has provided the math skills necessary in their career to present that student for graduation. Table one represents the environment constructs independent variables.

Table 2.

Environment Constructs Variables

Variable Name	Variable Description	Data Type	Value	Record
ASSIG	Placement	Nominal	0-103 1-102 2-092 3-091	Student Transcript

Outcome Construct

The outcome constructs consist of the three dependent variables that include: (1) developmental sequence completer, meaning completes the sequence of developmental math courses ASC 091 & 092; (2) completes the college-level math course sequence Math 102 & 103; or (3) earns an educational credential. Enrollment into math is assigned the value of 0, 1, 2, or 3, depending on the level of math assigned. Table three clarifies the outcome variables.

Table 3.

Outcome Construct Variables

Variable Name	Variable Description	Data Type	Value	Record
DSC	Developmental Course Sequence Completer, Completes Developmental Math Sequence (ASC 091 & 092)	Nominal	0-Yes 1-No	Student Transcript
CSC	College-Level Course Sequence Completer, Completes College-Level Math Course	Nominal	0-Yes 1-No	Student Transcript
ECE	Education Credential Earned	Nominal	0-Yes 1-No	Student Transcript

Fundamentally, acquiring an education is a process. The responsibility of the college personnel is to improve that process. In their efforts to improve student outcomes, two-year institutions are increasingly recognizing the value of tracking the progression of cohorts of students across intermediate points along the way to completion of college credentials (Offenstein & Shulock, 2010; Reyna, 2010). Longitudinal tracking of students makes it possible to identify where along their educational pathways students are likely to drop out and thus where colleges should focus their efforts to improve student retention. It also allows colleges to see if they are improving over time the rate at which students are progressing toward program completion.

CHAPTER IV

RESULTS

Sample

The study sample (n=213), consisted of students placed into one of the four math courses offered. The four math courses are referenced and measured individually and sequentially. The "developmental sequence" consists of two courses, ASC 091 and ASC 092. The second sequence is the "college-level sequence". The college-level sequence consists of the two college-level math courses, MATH 102 & 103. Completing any portion of the developmental sequence in combination with completing college-level math courses is often referred to in the study as completing the "entire" math sequence.

The two college-level math courses are MATH 102 and MATH 103. Students are required to successfully complete ASC 091 before they are allowed to enroll in the second level developmental course, ASC 092. Students are then required to successfully complete ASC 092 before being allowed to finally enroll in the first level college-level math course, MATH 102. All of the students that make up the sample were first-time, degree seeking, and enrolled full or part-time. All students were enrolled for the first time either fall semester 2012, spring semester 2013, or fall semester 2013 (see Table 4).

Table 4.

Students Math Course Placement

Math Course Sequence	Course Student Initially Placed (n = 213)	Percent
ASC 091	83	39%
ASC 092	32	15%
MATH 102	60	28%
MATH 103	38	18%
TOTAL	213	100%

Students Placed ASC 091

The number of students placed in ASC 091 Developmental Math (n=83) 39%. This group made up the largest percentage of the (n=213) students placed. This course is the first level developmental course of two in the developmental math sequence, and two levels below the first college-level math course, MATH 102. Of the 83 students initially placed in ASC 091 (39%), 55 of the 83 ASC 091 students or 66% of the students initially placed in ASC 091 completed the developmental math course successfully. These students, as they progress from their initial placement into ASC 091 will need to complete four-semesters or two-years of math coursework to complete the entire math sequence (ASC 091 & 092, and MATH 102 & 103). This can act as a barrier to completion.

Of students that did not successfully complete ASC 091 (34%) only a very few officially withdrew from the course and as a result most of the students earned a failing letter grade of "F". To measure persistence, in the end, seven of the 83 students (9%), were successful in completing the entire math sequence in this study's data range. The math sequence is completed when the student successfully completes MATH 103 and has

met the math requirements to earn an education credential. From the seven students that completed the math sequence, four (5%) eventually earned an educational credential. (see Table 5).

Table 5.

Students Placed in ASC 091 Developmental Math

Students Placed in ASC 091 (level 1)	Placed ASC 091 & Completed ASC 091	Placed ASC 091 & Did Not Complete "Developmental Math" Sequence ASC 091 & 092	Placed ASC 091 & Completed Entire Math Sequence 091, 092, 102 103 & Earned Credential	Placed ASC 091 & Completed Entire Math Sequence 091, 092, 102 103 & Did Not Earn Credential
83 of 213 39%	55 of 83 66%	28 of 83 34%	4 of 83 5%	3 of 83 4%

Students Placed ASC 092

Students placed in ASC 092 Developmental Math (n=32) 15%. This course had the least number of students placed from the total (n=213) students. This course is the second or the highest level developmental math course of the two developmental courses, and one level below the first college-level math course, MATH 102. Students are required to successfully complete this course before being allowed to enroll in the first college-level math course, MATH 102.

Following suit, from the students that did not successfully complete ASC 092 (50%), only a very few officially withdrew from the course and as a result most of the students earned a failing letter grade of "F". In the end, three students, or 6%, of this group, ASC 092, successfully completed the entire math sequence. From those three, one

student earned an education credential from the initial 32 students placed in ASC092. (see Table 6).

Table 6.
Students Placed in ASC 092 Developmental Math

Students Placed in ASC 092 (level 2)	Placed ASC 092 & Completed ASC 092	Placed ASC 092 & Did Not Complete "Developmental Math" Sequence ASC 091 & 092	Placed ASC 092 & Completed "Entire Math" Sequence 092, 102 103 Earned Credential	Placed ASC 092 & Completed" Entire MATH" Sequence 092, 102, & 103 Did Not Earn Credential
32 of 213 15%	16 of 32 50%	16 of 32 50%	1 of 32 3%	2 of 32 6%

Students Placed MATH 102

Students placed in the first college-level math course, MATH 102 (n=60) 28%. This course had the second-highest number of students placed from the sample (n=213). This course is the first college-level or "gateway" level math course. The math sequence at the institution consists of two- college-level math courses, MATH 102 and 103. Students placed into MATH 102 will be required to complete MATH 103 to successfully meet the math graduation requirements for the majority associate and associate of applied degrees at the institution represented in this study. Students that are placed into the highest level math course, MATH 103 are only required to complete that course to meet the math graduation requirements, and every other state or tribal institution of higher education in North Dakota through common course numbering.

Students placed into MATH 102 had the second-highest percentage of success. Forty-five, or 75%, of the 60 students initially placed into MATH 102 successfully completed. From the 45 successful students, 35 or 77% continued to complete the rest of the math sequence that would MATH 103. In conclusion, 18 or the 45 students that

successfully completed MATH 102 from the initial 60 students, 33%, went on to successfully earn an educational credential. (see Table 7).

Table 7.

Students Placed in MATH 102 Intermediate Algebra

Students Placed in MATH 102 (level 3)	Placed MATH 102 & Completed MATH 102	Placed MATH 102 & Did Not Completed "Entire Math" Sequence MATH 102 & 103	Placed MATH 102 & Completed "Entire Math" Sequence MATH 102 & 103 Earned Credential	Placed MATH 102 & Completed "Entire Math" Sequence MATH 102 & 103 Did Not Earn Credential
60 of 213 28%	45 of 60 75%	15 of 60 25%	18 of 45 33%	35 of 45 77%

Students Placed in MATH 103 College-Level Algebra

Students placed in MATH 103 college-level math (n=38) 18%. This course is the highest college-level math course in the math sequence. Students placed into MATH 103 upon successful completion will have met the math required to apply for graduation for most associate and associate of applied degrees and will be enrolled in only one-semester math.

This sub-group of students had the highest completion percentage across the board. Ninety-two percent or 34 of the 38 students completed the course. Sixteen of the 34 students earned an educational credential, and the remaining 19 (53%), from the 34 that successfully completed MATH 103 did not earn an educational credential.

Table 8.

Students Placed in College-Level MATH 103

Students Placed in MATH 103 (level 4)	Placed MATH 103 & Completed MATH 103	Placed MATH 103 & Did Not Complete MATH 103	Placed MATH 103 & Completed Earned Credential	Placed MATH 103 & Completed Did Not Earn Credential
38 of 213 18%	34 of 38 92%	4 of 38 8%	15 of 34 44%	19 of 34 56%

Questions

1. Is there a difference in students completing the first corresponding college-level math course in three years for those placed in developmental math courses versus those not placed?

The difference in proportion for students completing the first corresponding math course contingent on placement into developmental or college-level math resulted in a statistically significant difference, $\chi^2(1) = 72.19,\ p < .05$ with a higher percentage completing MATH 102 of those not placed in developmental math (see Table 9). The null hypothesis would be rejected.

Table 9.

Statistical Analyses Question 1

OBSERVED	**Placed Developmental Math**	**Not Placed in Developmental Math**	**Total**
Completed MATH 102	13 (11.3%)	45 (75.0%)	58
Did Not Complete MATH 102	102	15	117
Total	115	60	175

2. Is there a difference in student's persistence when completing the math sequence in three years, for students placed in a developmental math course versus those not?

The difference in persistence of students placed in a developmental level math course, ASC 091 or 092, in proportion to students placed in a college-level math course MATH 102 or 103, is statistically significant, $\chi^2(1) = 97.98\ p < .05$. The null hypothesis would be rejected. Therefore, it was found that a higher percentage of students persisted successfully when placed in college-level math versus students placed in a developmental math course. (see Table 10).

Table 10.

Statistical Analyses Question 2

OBSERVED	**Placed Developmental Math**	**Placed College-Level Math**	**Total**
Developmental Math Course Completer	15 (80.9%)	79 (69.0%)	94
College-Level Course Completer	100	19	119
Total	115	98	213

Table 11.

Cross Tabulation Question 2

Complete * Placed Cross tabulation					
			Placed Developmental Math	**Not Placed Developmental Math**	**Total**
Complete	acomplete	Count	15	79	94
		Expected Count	50.7	43.2	94
		% within Placed	13.0	80.6	44.1%
	not_comp	Count	100	19	119
		Expected Count	64.2	54.7	119
		% within Placed	87	19.4	55.9%
		Count	115	98	213
		Expected Count	115.0	98.0	213.0
		% within Placed	100%	100%	100%

3. Is there a difference in students earning an educational credential in three years of those placed in developmental math coursework versus those not?

The result of the analysis is that the difference in proportion between the variables of earned credential and does not earn credential was found to be statistically significant, $\chi^2(1) = 35.174,\ p < .05$ with a higher percentage of students earning an education credential if they were not placed in developmental math (see Table 12). The null hypothesis would be rejected.

Table 12.

Statistical Analysis Question 3

OBSERVED	**Placed Developmental Math**	**Not Placed in Developmental Math**	**Total**
Earns Educational Credential (percent)	4 (3.5%)	34 (34.7%)	38
Does Not Earn Educational Credential	111	64	175
Total	115	98	213

Table 13.

Cross Tabulation Question 3

Complete * Placed Cross tabulation			**Placed Developmental Math**	**Not Placed Developmental Math**	**Total**
Complete	acomplete	Count	4	34	38
		Expected Count	20.5	17.5	38.0
		% within Placed	3.5%	34.7%	17.8%
	not_comp	Count	111	64	175
		Expected Count	94.5	80.5	175.0
		% within Placed	96.5%	65.3%	82.2%
		Count	115	98	213
		Expected Count	115.0	98.0	213.0
		% within Placed	100%	100%	100%

CHAPTER V

DISCUSSION

Introduction

In this chapter, the researcher describes the findings of this study as they connect to the literature review and that of developmental education reform in America's community colleges. Then the researcher details what is known from a lifetime career in the field and the existing research around the best ways to address the needs of academically underprepared students, as well as discuss the limitations of this knowledge where it comes to creating policy. Chapter V includes a discussion, analysis of findings, outline of recommendations for reform, recommendations for future research on remedial and developmental education specific to students attending a tribal community college, and summary.

DISCUSSION

To make a claim from this study that developmental education, in the form of remedial coursework, is effective, cannot be concluded from this study, especially for the academically weakest students. What can be concluded based on the results of the progression from the 39% students placed in the first level developmental math course (ASC 091), is that developmental education, as it is structured currently at the host institution, is not serving the weakest math students. Like results were found in other development education studies where that consistently a generalization is drawn based on

a single institution's data, “it remains that effectiveness has never been clearly established, especially for the weakest students (Handel & Williams, 2011).”

Another concern regarding placement and developmental programs is that students with developmental needs are disproportionately represented by individuals from first-generation and low-income backgrounds (Boatman, & Long, 2013). Many of these students have academic risk factors that developmental courses can both alleviate and exacerbate. For instance, a developmental course maybe is paced or structured in such a manner that it meets a student’s current proficiency level as indicated by the placement score. However, for each developmental course taken, an at-risk students is potentially exposed to a new set of risk factors that include additional time to degree during which chaotic external factors threaten student progress, increased likelihood of financial aid friction related to lack of satisfactory academic progress, setbacks in articulation agreements between institutions where credit does not transfer, or simple inability to successfully navigate the next course in the sequence.

Analyses of Findings

The largest barrier for developmental math students is attempting their initial courses (Fong et al., 2015). The outcomes support a statement based on the results of this study. One-third (34%) of the students in this study that were placed and attempted the initial developmental course, ASC 091, did not complete the initial course successfully. Placing students into multi-semester, non-credit remedial course sequences, a pre-requisite to enrollment in college-level math, resulted in most students leaving the system and never making it to a college gateway course (Bailey, 2015; Vandal & Complete College, 2014). The research supports this statement based on the results that revealed as

high as 54% of the students in the study that were placed in developmental math courses never made it to a college-level gateway course, and did not return for the second year. In large part due to academic suspension, and based on the cumulative GPA's, which are the result of the student's absence to officially withdraw from courses, and indicated by failing all the courses in the semester(s) as opposed to only the math courses. Ideally, Students should begin taking credit-earning courses in their first year of college. However, nationally, 50% of students at public two-year colleges and 40% of students at public four-year colleges failed to complete their developmental coursework within six years.

For decades, scholars have documented the persistence challenges encountered by American Indian college students. With many studies it is shown the majority of American Indian students are the first in their families to attend higher education, have dependents, and live in poverty (AICF, 2011). Unquestionably, the influence of these factors contributes to higher dropout rates amount Native American Students. Overall, for this study persistence through developmental math as compared to college-level math was lower. Persistence, overall from the 213 students tracked for the three years that earned an educational credential was 18%. Four students that were originally placed into a developmental math course earned an educational credential. Thirty-four of the students that were originally placed into college-level math earned an educational credential. All students that earned a credential, graduated with either an associate's degree or associates of applied science degree.

Through-out the analysis persistence is identified as a concern. First, from a developmental course to the next level developmental at 13%. Then progression through

developmental math coursework as compared to college-level coursework indicates the substantial struggle progressing to the college-level math coursework. Recommended through-out this chapter it is indicated the first-year experience from placement testing, including pre-testing, to orientation, to first-year success course, to completing developmental coursework, and progression to the second year needs to be strengthened. Develop pathways perhaps through the math sequences as they are required in each program of study.

The higher that the student started in the trajectory, the more likely that they successfully completed transfer-level math within three years. This singularity was determined to be true in the study with those students that were placed in MATH 102 and 103. Both groups avoided any developmental math courses. Seventy-five percent (75%) or 45 of the 60 students placed in MATH 102, successfully completed. With 35 of the 45 students (77%) progressed forward to complete the next and final level math course, MATH 103. Completion rates differed based on students' initial placement level: 17% of students referred to the lowest level of developmental math completed the sequence, versus 45% of those referred to the highest level. (Bailey et al., 2010).

"The research is clear; long remedial education course sequences are a barrier, not a bridge to college" (Vandal & Complete College, 2014). The results of this study support that statement. There were (n=115) students (54%) placed in developmental math courses ASC 091 & 092. The remedial math sequence consists of two courses, which depending on which course the student was placed, could take the student an academic year (two semesters) to complete the developmental math courses before being allowed to enroll in the college-level math course that follows, MATH 102.

RECOMMENDATIONS FOR REFORM

This study has uncovered more evidence supporting the need for reform than evidence on what type of reform would work best. Overall, student success may be bolstered most strongly by multifaceted reforms to developmental education that both improve course placement accuracy and create more consistent standards of college readiness. The first recommendation is that the mathematics placement processes at the institution should be assessed regularly. Educational leaders and faculty that are involved in making and implementing mathematics placement processes at their institution have a responsibility to their incoming freshmen students that the placement is as accurate as possible.

A factor in the analysis of individual student's transcripts was that students in large part do not withdraw from courses as indicated by the failing letter grades “F” and seldom indicated by a "W" they were withdrawn. In addition, taking into consideration the high percentage of students, 47% or more that begin in the fall are suspended or depart following the spring semester and do not return for the second year, it becomes critical to address the large migration of students leaving after spring semester. As a result, the students will likely have two semesters of failed courses if and when they decide to return to the college that will have affected their GPA and eligibility for scholarships and most types of financial aid until the transcript is corrected and a satisfactory GPA is earned. There are indicators or frequencies of negative student experiences, such as not withdrawing either due to lack of awareness for when the student earns failing letter grades resulting in suspension. Suspension as opposed to withdrawing and maintaining their academic standing so that returning to the institution

could be accomplished with a new start as opposed to petitioning for re-admittance, retaking courses, and once again securing financial aid. Students, if academically suspended, have to sit out one semester before they can petition for readmissions. Strategic advising and two common student support policies could provide options for students to return in good academic standing and a chance at a fresh start. Academic bankruptcy and grade forgiveness policies with strategic advising and a first-year experience strategy developed to address the high population of first-generation students, all to enhance student progression from placement to successful outcome.

Some research suggests that large enrollments in developmental education may reflect misalignment between high school and college academic standards. An increasingly popular trend is to give students assessments earlier. The idea behind early assessment strategies is to offer college placement tests to students in high school, usually in their junior year, to remove the high-stakes context and provide information on skills deficiencies well before college entry. In a sense, this makes high schools accountable and responsible for remediation and could prevent any major reforms of the college testing, or instruction. The California State University System's Early Assessment Program is beginning to yield evidence that participation reduces student's probability of needing remediation; a study by Howell, Kurlaender, and Grodsky (2010) found that program reduced student's probability of needing remediation by roughly four percentage points in math.

With the high stop-out and students repeating failed courses, to allow for flexibility across programs of study, several states modularized the math curriculum into one-credit math courses, or units, such that students need to master only the competencies

required by their program. For example, Science, Technology, Engineering, and Math (STEM), programs require a greater number of developmental math units than do liberal arts and career-technical programs. Also, a modularized curriculum may allow students to pick up where they left off when they return, as opposed to those students who may stop and start a math course more than two or more times before successfully completing.

As Native Americans, we learn and understand visually. Conceptually, adopt the three-legged stool conceptual model. A visual to address, the visual learner, but; given the knowledge that incoming students are not well informed about the assessment and remedial placement policies and practices, there is a real need to expand and rigorously evaluate strategies aimed at improving awareness of preparation for placement exams. Besides consideration of a conceptual model, perhaps collaborating with the various bridge programs being conducted could be a starting point for that particular group of students. A group of students that will likely enroll at the host institution through the bridge program experience.

It is also the case that some students who are deemed prepared by the placement exam go on to fail college-level math. Some of these students have reasonably high academic test scores; they may fail college-level math due to poor non-cognitive skills (Hodara, Jaggars, & Karp, 2012). Skills that are not assessed by the traditional placement exam. Consider experimenting with a multi-level assessment for placement. The math placement process at might be modified to include student's high school mathematics GPA. A common thread in the study is the information being gathered but not gauged. The institution in the study requires high school transcripts or GED scores for the completion of their admissions process. Consider a policy of placement testing for

entering advanced students based on high school math GPA or better, ACT math scores allowing these to bypass the math placement process and automatically be placed appropriately into either MATH 102 or MATH 103. Understandably there are going to be issues to be ironed out in any type or level of reform, such as access to this information and in a timely manner. Multiple measures placement systems may combine information on test scores, high school GPA, highest course passed in the subject, and other measures to determine whether students are ready for college courses. At Long Beach City College, which implemented multiple measures in fall 2012, more students were placed into and passed college-level courses by 31% compared to the traditional math tests at 9% (Rivera, 2012).

In reviewing the Associate of Applied Science programs and taking consideration of the types of math skills necessary, the researcher suggests offering math skills specific to the program of study. For example, business math and accounting, then building on those math skills as progressing from certificate to AAS., creating stackable credentials and allowing for some options for success with a various levels of learners. Associate of applied science programs may the math pathways model designed by Charles A. Dana at the Center at the University of Texas at Austin and the Carnegie Foundation for the Advancement of Teaching replaced algebra with statistics and quantitative reasoning courses at both the developmental and college level for non-STEM students (Ganga, & Mazzariello, 2018). Not all require MATH 103, or perhaps a skills specific math would be more effective and appropriate such as business math. Take into consideration

Currently, all AA, AS and AAS programs of study at the institution requires students to complete a college-level gateway mathematics course to graduate, MATH 102

and/or MATH 103. Associate of applied science programs (AAS) is generally terminal career/technical programs of study in that the student plans to look for employment upon earning an AAS. Perhaps considering a scaled-down version of the IBEST model for AAS and other like programs. Integrated Basic Education and Skills Training (IBEST) is a nationally recognized instructional model that boosts students' basic skills in reading, writing, and math while they pursue a certificate in a career/technical program (Zeidenberg, Cho, & Jenkins, 2010).

Qualitative research has documented that students are often uninformed about the significance of placement tests (Venezia et al., 2010) still confused to discuss their results and subsequent course-taking options. Again, potentially amplified by the number of first-generation students. Recommend providing more structured, coherent paths through developmental requirements and make them relevant to the program of study. Consider redesigning the developmental math and to tailor the college-level or gateway math courses for students who intend to enter STEM fields or non-STEM fields, and specifically the AAS programs. When a student submits an admissions application to the host institution, they are assigned a student ID number and directed to another office that provides the ACCUPLACER online test. When completed, the student scores are available for an academic advisor online, and the student is then directed to their academic advisor. Once students complete the exam, they receive a printout. Testing center staff at one institution sat with students and placement results and explained their placement and options. Students need to know how well they performed to understand and move forward to have a reasonable chance of success.

College should consider implementing systematic pre-test preparation, such as that adopted by several institutions identified in the literature review that will likely reduce rates of under-placement. Pre-test preparation is relatively low in cost and easy to scale up; thus it would be feasible for resource-constrained community colleges. Along that same line, the institution has an opportunity to strengthen bridge programs for this purpose. Bridge programs offered in the summer but can also be available during the regular academic year. This provides an opportunity for students who test into or would test into, developmental education to improve skill proficiencies and thereby decrease the need for developmental education courses Kerrigan & Slater, 2010).

In addition, Research suggests that students enrolled in condensed courses, self-paced courses, and/or mainstreamed developmental courses show higher rates of persistence than students taking traditional developmental courses, yet causal questions about the effects of these programs on student outcomes remain unanswered (Jenkins, Speroni, Belfield, Jaggars, & Edgecombe, 2010; Edgecombe, 2011). At one point, the assessment and placement were determined by the Test of Adult Basic Education (TABE) and replaced by ACCUPLACER. Consideration should be given to explore again the reasons and recommendations for that type of assessment change and if it's time to reconsider the use of the TABE test for all or only some of the students depending on factors such as program of study, and high school achievement.

Recommend that additional tracking of the students who enroll in developmental coursework. These students are already at risk. What happened to the 80+ students that did not successfully complete the lowest level of developmental math? Do a large number of students that migrate out after the first year, or second semester, due to

suspension in large part, return after they have been suspended and are they successful the second time? This tracking could include attendance patterns with earlier interventions, tutoring usage, and weekly or even daily grade reports and feedback. Other examples, during orientation, the first-year seminar course, or from the academic advisor who should be monitoring advisees grades to offer interventions as opposed to a transcript of "F"s. With additional tracking appropriate advisement, support, and interventions could be utilized to increase student success and completion of a degree or certificate requirements.

It is important to separate and serve students independently and/or in like groups. TCUs serve a unique student with different needs. For students with significant needs, in this study, that would be the 83 students that were placed in ASC 091 developmental math, consider a sustained and intensive approach with wraparound supports. Research is still limited on the effects of developmental education on low-placing students and the best approaches to support them. Yet we often serve both similarly. Better-prepared students, those just below the cutoff for placement are required to enroll in a semester-long course when a short tutorial may be all that is required. Students with fewer skills, of course need far more assistance, perhaps multiple courses spanning two semesters or more. Even the most effective faculty members are challenged by students who failed one or more remedial courses. Such students are perhaps the most difficult students to serve, a result not only of their insufficient academic skills but also because of an internalized sense of failure.

Based on the results of this study, the final reform is recommended. Educational administrators and faculty who develop and implement placement processes should

regularly assess them for the reliability and validity of the data obtained from them. Necessary modifications to the mathematics placement processes should be continually made to improve their effectiveness to better meet the needs of both the students and faculty in postsecondary institutions. Effective mathematics placement processes will accurately place students in the appropriate entry-level college mathematics course; these students could then successfully complete the mathematics course.

Recommendations for Future Research

We now return to our original questions and consider implications for future research. There is a common consensus regarding the role of assessment and placement in community colleges in terms of maintaining open access to the institution while ensuring that students meet minimum standards before proceeding to college-level work. There is much less consensus, however, when it comes to determining and implementing assessment and placement policy.

The use of multiple measures in college entry assessment and placement has the potential to enable more students to enter the most appropriate level of coursework and increase their likelihood of success. Careful consideration is required to create systems that work well for both the institution and students. Decision making in this arena is hampered by a lack of high-quality research on the strategies discussed here by others. First (who others? reference them), more information is needed on the extent to which existing measurement tools, alone and in combination, predict success in initial college courses; currently, decisions have to be made with little clear evidence of their predictive validity. In addition, the field would benefit from high-quality evaluations of varied assessment and placement approaches that permit insights into their efficacy,

implementation requirements, costs, and benefits, and differential impact on varied student populations. Finally, research is needed on ways to bypass current approaches to assessment and placement altogether in favor of alternative ways of onboarding students.

Based on the large migration of students at the conclusion of an academic year, it is recommended consideration and research be given to the pedagogy structure and delivery of development education as it is presented. Research in regard to the migration of students and how does it compare to the American community college where 28% of students earn a degree within eight years, compared with 43% of those who did not take any developmental coursework (Attewell et al., 2006).

This research may also serve as an incentive to study other areas of the curriculum and support services at tribal colleges. It is certainly past time for tribal colleges to stop relying on research from institutions that are unlike the tribal college. It is time for tribal colleges to do and present their own research and develop their own evidence-based solutions that work with the populations that these colleges serve. More research is needed on the placement process itself. There is a lack of consensus on what it means to be prepared for college-level work, and as such, there are differing views of what would necessitate placing a student in a remedial or developmental course. Among two-year colleges, 92% of institutions use some kind of standardized placement exam to assign students to remedial or developmental education courses (Hughes & Scott-Clayton, 2011), but the exact cutoffs and tests used differ widely. As discussed, remedial courses may be more or less effective for students depending on the severity of their academic needs. Furthermore, recent research indicates that these college placement tests have little

correlation with student's future academic success, raising serious questions on how then to assess student's remedial needs (Burdman, 2012).

It is also necessary to continue finding ways to understand and assist this student population in student development given the small amount of literature on this subject.

Implications and Practice

This study has uncovered evidence supporting the need for the intake and first-year experiences at the host institution of this study be discussed to what type of reform would work best for these two particular practices, but this is not causing discouragement. Some of the reforms or alternatives discussed in the previous sections and this chapter are promising areas for wider implementation and more evaluation. It may be that the current system does work for some subsets of students, but we need to do a better job of assuring the systems works specifically and effectively for the overall population and each subset of students that make up the population.

From the research, there are indicators that students are struggling in the first year. Indicators that include the high migration of students at the end of the second semester, high number of students not withdrawing from courses, low number of returning students within the three years after they have been unsuccessful and suspended, maybe due in large to the first-generation student and their limited support in terms of policy and procedure for these types of student experiences.

The placement process is an important point of contact with students, providing an opportunity to identify key areas of academic and non-academic strengths and weaknesses to which appropriate interventions and coursework may be offered. The placement process is also a critical link along the educational pipeline, and improvements

to it could build stronger connections between the secondary and post-secondary systems, as well as between colleges in the same state or system. Institutions providing developmental education have to establish and manage faculty and student expectations regarding developmental education. Related to the establishment of clearly-specified goals and objectives for developmental education programs, the communication of explicit expectations for both student and program providers enriches the effectiveness of developmental programs. Clearly, from the work I do at a tribal community college, increasingly students are coming to college with uninformed expectations. In the case of the tribal college, this mismatch results both from the high percentage of first-generation college students who lack role models to communicate accurate expectations and from student's experiences with the expectations in their secondary schools.

For the reliability and validity of the data obtained with placement exams, necessary modifications to the mathematics placement processes should be continually made to improve its effectiveness to better meet the needs of both the students and faculty. Effective mathematics placement processes will accurately place students in the appropriate entry-level college mathematics course; these students will then be likely to successfully complete the mathematics course. It is important that mathematics placement procedures be as accurate and efficient as possible. Each independent variable in the mathematics placement process at the postsecondary institution should be investigated as to the extent of its contribution to the prediction of the dependent variable, earned an education credential.

Assess and redesign a quality and mandatory student assessment, placement and advising system and effectively places students into appropriate levels of developmental

course and/or academic and personal support services as needed at the beginning of their college careers is important to student success (Saxon & Morante, 2014).

Finally, campus administrators and policymakers should be aware that remediation efforts need not focus solely on the skills students did not learn in the past, but can instead attempt to identify and provide the skills students will need for a future career or academic major. Efforts to redesign the ways in which remediation is offered should be focused much more explicitly on the areas in which students most need improvement. By helping to redefine developmental education more as academic support than a curricular burden, tribal colleges will be much more successful in helping their underprepared students to succeed. Future policy changes should continue this focus on differentiated delivery based on student skill and placement level as more institutions look to customize instruction to address specific student deficiencies (Boatman & Long, 2010).

Summary

One placement test and one study cannot possibly tell the entire story of the students who are placed in developmental coursework. This study provides a beginning to examine what occurs at one tribal college. It will provide the appropriate committees with information to assist in making decisions and in recommending areas to examine retention and course and curriculum development.

While the field has yet to reach a consensus regarding the best directions for reform for remediation, through this study we see consensus around the need for change in order to drastically improve persistence and graduation rates. Of course, improving is only one facet of a broader agenda for reforming developmental education, but since

student's first experience is with the assessment and placement process, this is a good place as any to begin.

REFERENCES

Achieving the Dream. (2019). *College Readiness*. [online] Available at: https:// achievingthedream.org/ focus-areas/college-reading

American College Testing Program (ACT). (2013). *The Condition of College and Career Readiness 2013: First-Generation Students: National - ACT*. Retrieved from www.act.org/content/dam/act/unsecured/.../CCCR13-NationalReadinessRpt.pdf

American College Testing Program (ACT). (2016). *The Condition of College and Career Readiness 2016: National-ACT*. Retrieved from https://www.act.org/content/act/en/ research/condition-of-college-and-career-readiness-2016

American College Testing Program. (2017). *The Condition of College and Career Readiness 2017: National - ACT*. Retrieved from http://www.act.org/content/act/en/research/ condition-of-college-and-career-readiness-2017

American Indian Higher Education Consortium and the Institute for Higher Education Policy. (1999). *Tribal colleges an introduction*. Washington, DC: Institute for Higher Education Policy and American Indian College Fund. Retrieved from https://eric.ed.gov

American Indian Higher Education Consortium (AIHEC). (2012). *2009-2010 AIHEC AIMS Fact Book: Tribal Colleges and University Report.* Alexandria, VA: American Indian Higher Education Consortium. Retrieved from http:www.aihec.org/our-stories/docs/reports/ AIHEC_AIMSreport_May2012.pdf

American Indian College Fund. (2011). *Facts about American Indian education*. Denver, CO: Author. Retrieved from http://www.collegefund.org/userfiles/2011_FactSheet.pdf

American Institutes for Research & SRI. (2009). *Early college high school initiative evaluation synthesis report: Six years and counting: The ECHSI matures*. Washington, DC: American Institutes for Research.

American Mathematical Association of Two-Year Colleges. (2018). *IMPACT: Improving mathematical prowess and college teaching*. Memphis, TN: Author.

Armstrong, W. B. (2000). The association among student success in courses, placement test scores, student background data, and instructor grading practices. *Community College Journal of Research and Practice*, 24(8), 681-695. doi: 10.1080/10668920050140837

Astin, A. W. (1993). *What matters in college: Four critical years revisited.* San Francisco, CA: Jossey-Bass Publishers.

Attewell, P., Lavin, D., Thurston, D., & Levey, T. (2006). New Evidence on College Remediation. *The Journal of Higher Education.* doi:10.1080/00221546.2006.11778948

Bailey, T. R. (2015). *What we know about guided pathways* (CCRC Research Overview). Retrieved from http://ccrc.tc.coumbia.edu/media/k2/attachments/What-We-Know-Guided-Pathways.pdf

Bailey, T., & Cho, S. W. (2010). *Developmental education in community colleges*. (Issue Brief) Prepared for: The White House Summit on Community Colleges. Teachers College, Columbia University.

Bailey, T., Jeong, D.W., & Cho, S. W. (2010). *Student progression through developmental sequences in community colleges.* (CCRC Brief, Number 45). Community College Research Center, Columbia University. Retrieved from http://ccrc.tc.columbia.edu /Publication.asp?UID=812

Bailey, T., Jeong, D. W., & Cho, S. W. (2010). Referral, enrollment, and completion of developmental education sequences in community colleges. *Economics of Education Review, 29, 255-270.* doi:10.1016/j.econedurev.2009.09.002

Bailey, T. (2009). Challenge and opportunity: Rethinking the role and function of developmental education in community college. *New Directions for Community Colleges,* 11–30. doi:10.1002/cc.352

Bailey, T. R., Jaggers, S. S., & Jenkins, D. (2015). *Redesigning America's community colleges: A clearer path to student success*. Boston, MA: Harvard University Press.

Bauer (2010). *Do they work? Developmental courses in mathematiucs and English at sitting bull college*. Dissertation.

Belfield, C. R., & Crosta, P. M. (2012). *Predicting success in college: The importance of placement tests and high school transcripts* (CCRC Working Paper No. 42). New York, NY: Columbia University, Teachers College Community College Research Center.

Belfield, C. R., Crosta, P. M., & Jenkins, D. (2014). *Can community colleges afford to improve completion? Measuring the cost and efficiency consequences of reform*. Educational Evaluation and Policy Analysis, 36(3), 327–345.

Belfield, C., Crosta, P. & Jenkins, D. (2013). *Can community colleges afford to improve completion? Measuring the costs and efficiency effects of college reforms* (CCRC

Working Paper No. 55). New York: Community College Research Center, Teachers College, Columbia University.

Belfield, C., Jenkins, D., & Lahr, H. (2016). *Is corequisite remediation cost-effective? Early findings from Tennessee* (CCRC Working Paper No. 62). New York: Community College Research Center, Teachers College, Columbia University.

Bill & Melinda Gates Foundation. (2009). *Postsecondary success strategy overview*. Retrieved from http://www.gatesfoundation.org/What-We-Do/ US-Program/Postsecondary-Success

Bettinger, E. P., & Long, B. T. (2005). "Remediation at the Community College: Student Participation and Outcomes". *New Directions for Community Colleges* 129: 17-26.

Bettinger, E. Boatman, A., & Long, T. (2013). Student supports: developmental education and other academic programs. Retrieved from https://files.eric.ed.gov/fulltext/EJ1015252.pdf

Boatman, A., & Long, B. (2013). *The role of remedial and developmental courses in access and persistence.* New York: Routledge Books. Retrieved from http://scholar.harvard. edu/files/btl/files/long_boatman_2013_role_of_remediation_in_access_and_persistence_-_acsfa_routledge.pdf

Boatman, A., & Long, B. (2010a). *Does remediation work for all students? How the effects of postsecondary remedial and developmental courses vary by level of academic preparation* (NCPR Working Paper). New York, NY: National Center for Postsecondary Research.

Boatman, A., & Long, T. (2017b). *Does remediation work for all students? How the effects of postsecondary remedial and developmental courses vary by level of academic preparation?* doi.org/10.3102/0162373717715708

Bonham, B. S., & Boylan, H. R. (2011). Developmental mathematics: Challenges, promising practices, and recent initiatives. *Journal of Developmental Education*, 36(2), p. 14-21. Retrieved from https://eric.ed.gov/?id=EJ986273

Boylan, H. R., & Bonham, B. S. (2014). *Developmental education: Readings on its past, present, and future*. New York: Bedford/St. Martins.

Boylan, H. R., Brown, P. L., & Anthony, S. W. (2017). *The "Perfect Storm" of Policy Issues and Its Impact on Developmental Education*. The National Association for Developmental Education (NADE) Digest, Volume 9, Number 1. Retrieved from http://nade.net/ digest.htm

Brayboy, B. M. J., & Castagno, A. E. (2011). Indigenous millennial students in higher education. In F. A. Bonner II, A. F. Marbley, & M. F. Howard-Hamilton (Eds.). *Diverse millennial students in college: Implications for faculty and student affairs.* (pp. 137-155). Sterling, VA: Stylus.

Butrymowicz, S. (2017). *Most colleges enroll students who aren't prepared for higher education.* The Hechinger Report. Retrieved from https://www.pbs.org/newshour/education/colleges-enroll-students-arent-prepared-higher-education

Burdman, P. (2012). A higher threshold: Promoting successful transitions from high school to college. Paper for the Bill & Melinda Gates Foundation. Unpublished.

Calcagno, J. C., Crosta, P. M., Bailey, T., & Jenkins, D. (2007). Stepping stones to a degree: The impact of enrollment pathways and milestones on community college students. *Research in Higher Education, 48*(7), 775-801.

Carney, C. (1999). *Native American higher education in the United States*. Piscataway, NJ: Transaction Publisher.

Carnevale, A. P., Smith, N., & Strohl, J. (2010). *Help wanted: Projections of jobs and education requirements through 2018.* Report prepared by the Georgetown University Center on Education and the Workforce. Web site: http://cew.georgetown.edu/jobs2018

Carrell, S. E., Fullerton, R. L., & West, J. E. (2009). Does your cohort matter? Measuring peer effects in college achievement. Retrieved from http://faculty.econ.ucdavis.edu /faculty/scarrell/peer3.pdf

Center for Community College Student Engagement (CCSE). (2016). *Expectations meet reality: The underprepared student and community colleges.* Austin, TX: The University of Texas at Austin, College of Education, Department of Educational Administration, Program in Higher Education Leadership.

Chen, X. (2016). Remedial Coursetaking at U.S. Public 2- and 4-Year Institutions: Scope, Experiences, and Outcomes (NCES 2016-405). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch.

Cohen, A. M., & Brawer, F. B. (2002). The American community college. 4th ed. San Francisco: Jossey-Bass Publishers.

Conforti, P., Sanchez, J., & McClarty, K. (2014). *Developmental education: New approaches for the 21st century.* Presented at National Association for Developmental Education (NADE) Annual Conference. Dallas, Texas.

Conley, D. (2007). *Redefining college readiness.* Educational Policy Improvement Center. Retrieved from https://erc.cehd.tamu.edu/sites/erc-dev.cehd.tamu.edu/files/ERC_Documents/1_Redefining%20College%20Readiness%20article.pdf

Conley, D. (2010). Replacing remediation with readiness. National Center for Postsecondary Research Conference on Developmental Education. New York: http://www.postsecondaryresearch.org/conference/PDF/NCPR_Panel2_Conley.pdf

Crisp, G., & Delgado, C. (2014). The impact of developmental education on community college persistence and vertical transfer. *Community College Review, 42*(2), 99–117.

Cullinane, J., & Treisman, P. U. (2010). *Improving developmental mathematics education in community colleges: A prospectus and early progress report on the Statway initiative*. National Center for Postsecondary Research Conference on Developmental Education. New York, NY.

Dine College (2014). History. Retrieved from http//www.dinecollege.edu/about.history.php

Dotzler, J. J. (2003). A note on the nature and history of post-secondary developmental education in America. *Mathematics and Computer Education, 37*(1), 121. Retrieved from https://www.learntechlib.org/p/165622

Edgecombe, N. (2016). *Accelerating the academic achievement of students referred to developmental education* (CCRC Working Paper No. 30). New York, NY: Columbia University, Teachers College, Community College Research Center.cc.20220

Edgecombe, N. (2016). *The redesign of developmental education in Virginia*. doi:10.1002/

Epper, R. M., & Baker, E. D. (2009). *Technology solutions for developmental math: An overview of current and emerging practices.* Report funded by the William and Flora Hewlett Foundation and the Bill and Melinda Gates Foundation.

Fields, R., & Parsad, B. (2012). *Tests and cut scores used for student placement in postsecondary education: Fall 2011*. Washington, DC: National Assessment Governing Board.

Fong, K. E., Melguizo, T., Prather, G. (2015). Increasing success rates in developmental math: The complementary role of individual and institutional characteristics. *Research in Higher Education*. doi.org/10.1007/s11162-015-9368-9

Gonzalez, J. (2012). *Tribal colleges offer basic education to students* "Not Preparing for College.". Retrieved from http://chronicle.com/section/About-the-Chronicle/83

Grubb, W. (2011). Assessment and alignment: *The dynamic aspect of developmental education* (Basic Skills Instruction in California Community College, Working Paper No. 7) Stanford, CA: Stanford University, Policy Analysis for California Education.

Handel., & Williams, R. (2011). Reimagining Remediation-Creating First Chances for Second Chance Students. *The Magazine of Higher Learning*, 43(2). doi:10.1080/00091383.2011. 556921

Hanford, E. (2016). *College students increasingly caught in remedial education trap*. American Public Media. Retrieved from https://www.apmreports.org/story/2016/08/18/remedial-education-trap

Hern, K. (2012). *Acceleration across California: Shorter pathways in developmental English and math*. doi.org/10.1080/00091383.2012.672917

His Horse Is Thunder, D. (2012). Breaking Through Tribal Colleges and Universities.

Hodara, M., Jaggars, S., & Karp, M. (2012). *Improving developmental education assessment and placement: Lessons from community colleges across the country* (CCRC Working Paper No. 51) New York, NY: Columbia University, Teachers College, Community College Research Center.

Hodara, M. (2011). Reforming mathematics classroom pedagogy: *Evidence-based findings and recommendations for the developmental math classroom* (CCRC Working Paper No. 27) Assessment of Evidence Series. New York, NY: Columbia University, Teachers College, Community College Research Center. Web site: http://ccrc.tc.columbia.edu/ Publication.asp?uid=858

Hodara, M., Smith Jaggars, S., & Mechur Karp, M. (2012). *Improving developmental education placement and assessment: Lessons from Community colleges across the country* (CCRC Working Paper Number 51) New York, NY: Community College Research Center, Teachers College, Columbia University.

Hodara, M., Jaggars, S., & Karp, M. (2012). *Improving developmental education assessment and placement: Lessons from community colleges across the country* (CCRC Working Paper No. 51) New York, NY: Community College Research Center, Teachers College, Columbia University.

Howell, J., Kurlaender, M., & Grodsky, E. (2010). *The effect of the early assessment program at California state university*. doi:10.2307/40802189

Howell, J., Kurlaender, M., & Grodsky. E. (2010). Postsecondary Preparation and Remediation: Examining the Effect of the Early Assessment Program at California State University. *Journal of Policy Analysis and Management* 29:726–748.

Hagedorn, L. S. (2005). *How to define retention: A new look at an old problem*. In A. Seidman (Ed.), College student retention (pp. 89-105). Westport: Praeger Publishers.

Homeland Security. (2019). What is community college? Retrieved from https:// studyinthestates.dhs.gov/2012/03/what-is-community-college

Hughes, K. L., & Scott-Clayton, J. (2011). *Assessing developmental assessment in community colleges* (CCRC Working Paper No. 19) Assessment of Evidence Series). New York, NY: Community College Research Center, Teachers College, Columbia University.

Jaggars, S., & Hodara, M. (2011). *The opposing forces that shape developmental education: Assessment, placement, and progression at CUNY community colleges* (CCRC Working Paper No 36) Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/opposing-forces-shape-developmental.pdf

Jenkins, D., Smith, S. S., Jaggars, S., Zeidenberg, M., Cho, S. W., & Roksa, J. (2009). *Strategies for promoting gatekeeper course success among community college students needing remediation: Research report for the Virginia Community College System*. New York, NY: Columbia University, Teachers College, Community College Research Center.

Jenkins, D., Speroni, C0., Belfield, C., Jaggars, S. S., & Edgecombe, N. (2010). *A model for accelerating academic success of community college remedial English students: Is the accelerated learning program (ALP) effective and affordable?* (CCRC Working Paper No. 21.) New York, NY: Community College Research Center, Columbia University.

Jimenez, L., Sargrad, S., Morales, J., & Thompson, M. (2016). *Remedial education the cost of catching up*. Center for American Progress.

Kerrigan, M., & Slater, D. (2010). *Collaborating to create change: How EL Paso community college improved the readiness of its incoming students through achieving the dream. Culture of Evidence Series* (Report No. 4) Community College Research Center, Teachers College, Columbia University.

Kirst, M. (2007). *Who needs it? Identifying the proportion of students who require postsecondary remedial education is virtually impossible*. National Crosstalk, 15(1).

Kosiewicz, H., Ngo, F., & Fong, K. (2016). *Alternative models to deliver developmental math: Issues of use and student access*. doi:10.1177/0091552116651490

Kurlaender, M., & Howell, J. S. (2012). *Academic preparation for college. Evidence on the importance of academic rigor in high school*. Background Paper. The College Board. Advocacy & Policy Center Affinity Network.

Leonard, K. J. (1996). *Implementing Astin's I-E-O model in the study of student retention: A multivariate time dependent approach.* Association for Instititutional Research Annual Form Paper. Retrieved from https://files.eric.ed.gov/fulltext/ED397732.pdf

Lumina Foundation. (2015). *A stronger nation through higher education: Ten-year time horizon brings goal 2025 into sharp focus*. (Annual Report). Retrieved from http://www. luminafoundation.org/files/publications/A_stronger_nation_ through_higher_education-2015.pdf

Mattern, K. D. & Packman, S. (2009). *Predictive validity of ACCUPLACER scores for course placement: A meta-analysis* (Research Report No. 2009-2) New York, NY: College Board.

Melguizo, T., Bos, J., Ngo, Millis, & Prather, G., (2016). Using a regression discontinuity design to estimate the impact of placement decisions in developmental math. *Research in Higher Education Journal.*

Melguizo, T., Hagedorn, L. S., & Cypers, S. (2008). Remedial/developmental education and the cost of community college transfer: A Los Angeles county sample. *The Review of Higher Education*. doi:10.1353/rhe.0.0008

Melguizo, T., Bos, J., Prather, G., Kosiewicz, H., Fong, K., & Ngo, F. (2015). *Assessment and placement policies and practice in developmental math*. Rossier School of Education. University of Southern California.

McCleary, B. (1997). *Survey of remedial education in higher education more relevant to politics than to teaching and curriculum*. ERIC ED407685.

Merisotis, J. (2018). *Everyone has an opinion about the value of college. Tony Carnevale has the facts*. Lumina Foundation.

Mireles, S., Acee, T., & Gerber, L. (2014) FOCUS: Sustainable mathematics successes. *Journal of Developmental Education,* 38(1).

NASPA Foundation. (2017). *Defining first-generation*. Blog. NASPA, 111 K Street NE, 10th Floor, Washington, DC, 20002. Retrieved from https://firstgen.naspa.org/blog/defining-first-generation

Nelson, C., & Frye, J. (2016). *Tribal college and university: Tribal sovereignty at the intersection of federal, state, and local funding*. American Council on Education. Center for Policy Research and Strategy, Minority-Serving Institutions Series, Washington, D.C. Retrieved from www.acenet.edu/news-room/Documents/Tribal-College-and-University-Funding.pdf

Bracco, K. R., Austin, K., Bugler, D., & Finkelstein, N. (2015) *Reforming developmental education to better support students' postsecondary success in the common core era*. Policy Brief. WestEd. Retrieved from https://www.luminafoundation.org/files/ resources/reforming-dev-ed.pdf

Park, T., Woods, C. S., Hu, S., Jones, T. B., & Tandberg, D. (2016). *What happens to underprepared first-time-in-college students when developmental education is optional? The case of developmental math and intermediate algebra in the first semester.* https://doi.org/10.1080/00221546.2017.1390970

Parker, T. L., Bustillos, L. T., & Behringer, L. B. (2010). *Remedial and developmental education policy. at a crossroads.* Policy Research on Preparation Access and Remedial Education. University of Massachusetts.

Pierce, C. (2017). *Research-based integrated reading and writing course development*. Retreived from https://files.eric.ed.gov/fulltext/EJ1168753.pdf

Perin, D. (2011). Facilitating student learning through contextualization: A review of evidence. *Community College Review* (July). New York, NY: Columbia University.

Quint, J., Jaggars S. S., & Byndloss Asya Magazinnik, C. D. (2013). *Bringing education to scale.* Retrieved from https://www.mdrc.org/sites/default/files/Bringing%20Developmental%20 Education%20to%20Scale%20FR.pdf

Rutschow, E. Z., & Schneider, E. (2011). *Unlocking the gate: What we know about improving developmental education*. New York, NY: MDRC.

Rodriguez, O. (2014). *Increasing access to college-level math: Early outcomes using the Virginia placement test* (CCRC Research Brief No. 58) New York, NY: Columbia University Teachers College, Community College Research Center.

Rodriguez, O., Bowden, B., Belfield, C., & Scott-Clayton, J. (2014). *Remedial placement testing in community colleges: What resources are required, and what does it cost?* (CCRC Working Paper No. 73) New York, NY: Community College Research Center, Teachers College, Columbia University.

Safran, S., & Visher, M. (2010). Case studies of three community colleges. The policy and practice of assessing and placing students in developmental education courses. New York, NY: MDRC.

Saxon, P., & Morante, E. A. (2014). Effective student assessment and placement: Challenges and recommendations. *Journal of Developmental Education*, 37(3).

Strong Schools 2008. *Diploma to nowhere.*Washington, DC: Author. Retrieved from http://www.edin08.com

Scott-Clayton, J., Crosta, P. M., & Belfield, C. R. (2014). *Improving the targeting of treatment: Evidence from college remediation.* (NBER Working Paper No. 18457) Cambridge, MA:
National Bureau of Economic Research.

Scott-Clayton, J. (2012). *Do high-stakes placement exams predict college success?* (CCRC Working Paper No. 41) New York, NY: Columbia University, Teachers College, Community College Research Center.

Scott-Clayton, J., Crosta, P. M., & Belfield, C. R. (2014). Improving the targeting of treatment evidence from college remediation. *Educational Evaluation and Policy Analysis*, 36 (3), 371–393. doi:10.3102/0162373713517935

Scott-Clayton, J., & Rodriguez, O. (2012). *Development, diversion, or discouragement or diversion? New evidence of the effects of college remediation* (Working Paper 18328) New York, NY: Teachers College, Columbia University, Community College Research Center. Retrieved from http://nber.org/papers/w18328

Starks, J. E. (2010). *Factors influencing the decisions of Native Americans to attend or not attend college or vocational school: A phenomenological study*. College of Saint Mary.

Stein, W. (2003). *The renaissance of American Indian Higher education: Capturing the dream*. New York: Routledge Taylor & Francis Group.

Strong Start to Finish. (2019). *Sources*. Website https://strongstart.org/sources

Stewart, S., Lim, H., & Kim, J. (2015). Factors influencing college persistence for first-time students. *Journal of Developmental Education*, 38(3).

Office of the Press Secretary, December 02, 2011. Executive Order 13592 - *Improving American Indian and Alaska Native educational opportunities and strengthening tribal colleges and universities.* Retrieved from https://obamawhitehouse.archives.gov/the-press-office/2011/12/02/executive-order-13592

Oppelt, N. (1990). *The tribally controlled Indian colleges: The beginning of self-determination in American Indian education*. Tsaile, AZ: Dine College Press.

Rivera, C. (2012). *Long beach college promise*. Retrieved from https://www.lbcc.edu/post/lbcc-promise-pathways

Smith, A. A. (2016). Evidence of remediation success. *Inside Higher Ed*. Retrieved from https://www.insidehighered.com/news/2016/04/

Thiel, P. A. (2008). *The optimistic thought experiment*. Policy Review. Hoover Institution (pp. 45).

Thunder, D., Anderson, N., & Miller, D. (2013). Building the Foundation for Success Case Studies of Breaking Through Tribal Colleges and Universities. AIHEC.

Tinto V. (1993). Leaving College: *Rethinking the causes and cures of student attrition*. (2nd ed.). Chicago, IL: University of Chicago Press.

Tinto, V. (1997). Classrooms as communities: Exploring the educational character of student persistence. *The Journal of Higher Education,* 68, 599-623. doi:10.2307/2959965

Tinto V. (2004). Student retention and graduation: Facing the truth living with the consequences. (Occasional Paper 1) The PELL Institute. Retrieved from https://files.eric.ed.gov/fulltext/ ED519709.pdf

Tierney, J. (1992). *Official encouragement, institutional discouragement: Miorities in academe: The Native American experience.* Norwood, NJ: Ablex Publishing Corporation.

U.S. Department of Education, National Center for Education Statistics (NCES). (2010). *The condition of education 2004* (NCES 2004–0777). Washington, DC: U.S. Government Printing Office. University of Georgia, "Academic Affairs Handbook: Section 2.9.1 Administrative Procedures for Learning Support Programs".

U.S. Department of Education, National Center for Education Statistics (NCES). (2016). Remedial coursetaking at public 2- and 4- year institutions: Scope, experience, and outcomes. Retrieved from https://nces.ed.gov/pubs2016/2016405.pdf

U.S. Department of Education, National Center for Education Statistics (NCES).

U.S. Department of Education. National Center for Education Statistics. (2019). The Condition of Education. Under Graduate Retention and Graduation Rates.

Venezia, A., Kirst, M. W., & Antonio, A. L. (2003). *Betraying the college dream: How disconnected K-12 and postsecondary education systems undermine student aspiration*. Sanford, CA: Standford Institute for Higher Education Research.

Venezia, A., Bracco K. R., & Nodine, T. (2010). One-shot deal? Students' perceptions of assessment and course placement in California's community colleges. San Francisco, CA: WestEd.

York, T., Gibson C., & Rankin, S. (2015). Defining and measuring academic success. Practice Assessment, Research & Evaluation. 20.

Zeidenberg, M., Cho, S. W., & Jenkins, D. (2010). Washington state's Integrated basic education and skills training program (I-BEST): New evidence of effectiveness (CCRC Working Paper No. 20.) New York, NY: Community College Research Center.

Vandal, B. (2014). Promoting Gateway Course Success: Scaling Co-Requisite Academic Support. Washington, D. C.: Complete College America.

Winters, N. (2012). From the reservation: A theory regarding the development of Native American students. *Journal of The Indiana University Student Personnel Association*. Retrieved from https://education.indiana.edu/graduate/programs/hesa/iuspa/archive/2012-03-Reservation.pdf