FACTORS THAT INFLUENCE GRADUATION EFFICIENCY OF BACCALAUREATE RECIPIENTS AT WEBER STATE UNIVERSITY

by

Casey Dee Bullock

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STATEMENT OF DISSERTATION APPROVAL

The dissertation of **Casey Dee Bullock**

has been approved by the following supervisory committee members:

Jason Taylor	, Chair	**03/24/2017** Date Approved
Amy A. Bergerson	, Member	**03/24/2017** Date Approved
Andrea K. Rorrer	, Member	**03/24/2017** Date Approved
Phyllis C. Safman	, Member	**03/24/2017** Date Approved
Heather J. Chapman	, Member	**03/24/2017** Date Approved

and by **Gerardo R. López**, Chair/Dean of

the Department/College/School of **Educational Leadership and Policy**

and by David B. Kieda, Dean of The Graduate School.

ABSTRACT

Policymakers at the state and national levels have identified college completion as a key policy priority. The proportion of adults with a college credential has decreased and the equity gap in college completion is expanding. Given this policy context, there is an interest in the extent to which degree pathways are inefficient and how these inefficiencies may contribute to degree completion. Many factors influence degree efficiency. This study examines what variables affect degree efficiency for students who graduated from Weber State University (WSU) during the 2013-2014 and 2014-2015 academic years. The Graduation Efficiency Index (GEI), develop by Gillmore and Hoffman at the University of Washington, is used to measure degree efficiency. The variables studied, using multiple regression, include student demographic factors, student transfer information, degree changes, and the curriculum structure. Using problem-structuring policy analytic methodology, this study will provide information about the problems that affect the students' pathway to graduation. This study found, among demographic and precollege academic characteristics, that age at graduation, nonresident status (US), and dual enrollment programs affect degree efficiency. Among the demographic and precollege academic characteristics, only dual enrollment has a positive effect on degree efficiency. Conversely, older and/or nonresident (US) student demographics have shown to decrease graduation efficiency. Additionally, transfer and academic characteristics indicated that transfer students, number of transfer institutions,

number of major changes, transfer associates degree, WSU associates degree, failing a course, withdrawing from a course, and repeating course, all had a negative effect on degree efficiency. The single variable with the most positive affect on graduation and with the largest impact on the predicted GEI was the student grade point average (GPA) at time of graduation. The most significant negative impact on the predicted GEI was transfer associates degree. Curriculum structure investigated what impact the percentage of free electives in a program of study has on the predicted GEI. Free electives had a positive effect on the GEI. However, the efficacy is low and requires a substantial portion of the program of study, such as 25%, to have a meaningful affect on the GEI.

This dissertation is dedicated to my loving wife who has encouraged and believed in me throughout this process.

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GLOSSARY OF TERMS

Attempted Credit Hours: Attempted credit hours are the number of credit hours that a student attempted or was enrolled in after the 15th business day of the semester. Courses not counted towards attempted hours are those where the student enrolled in and then dropped previously to the 15th day of the semester. However, any course dropped after the 15th day of the semester will show with a W in place of the grade on the students' transcript and count towards the attempted credit hours. Courses that are remedial, repeated, or failed also count towards the attempted credit hours.

Bachelor's Degree: 120-semester credit hours is the minimum total credit hours required for a bachelor's degree. However, some bachelor's degrees may exceed the minimum 120-semester credit hour limit. Bachelor's degrees include Bachelor of Arts (BA), Bachelor of Fine Arts (BFA), Bachelor of Music (BM), Bachelors of Music Education (BME), Bachelor of Science (BS), and Bachelor of Integrated Studies (BIS).

Credit Hour: A credit hour is a unit of measurement, associated with a course, commonly used to measure faculty instructional workload and a resource measure in budgeting. One credit hour is equivalent to one hour of lecture in a face-to-face course. In addition to translating learning into credentials, credit hours are also used as the basis for student transfer (Wellman, 2003a, 2003b, 2003c).

Curriculum Structure: The curriculum structure consists of all requirements of the degree. The structure consists of the general education, major, and minor requirements, including any free electives. This term is often interchangeable with the program of study.

Curriculum Structure Percentage: The percentage is a calculation based on the number of free electives (see Free Electives below) in the program of study versus the amount of required credit. The calculation is the sum of all general education, major and minor required credit hours subtracted from the minimum degree requirement, 120-semster credit hours. The remaining number is the free electives. Therefore, if a program required 105 credit hours, 15 free electives remain. The percentage is 14.3%.

Cumulative Attempted Hours: Total attempted credit hours including both transfer and WSU course work.

Cumulative GPA: The calculated GPA of all courses including WSU and transfer courses.

Earned Hours: After grades are recorded, earned hours are the number of semester credit hours that a student earned. Earned hours only include courses the student has passed. Earned hours have a grading scale of letter grades (A, A-, B+, B, B-, C+, C, C-, D+, D, D-), credit (CR) or special credit (SC).

Excess Credit: Excess credit is credit that a student earns that is beyond what is required to complete the degree. For example, if a bachelor's degree requires 120 credit hours and a student graduates with 136 credit hours, the student has 16 credit hours in excess credit.

Free Electives: After general education, major, and minor requirements are met, free electives are the total credit hours remaining to meet the minimum 120-semster credit hour total for a bachelor's degree. For example, if a program of study requires 42-semester credit hours in general education, 48-semester hours in major requirements and 15-semester credit hours in minor requirements the student will need to complete 15-semester credit hours of free electives to meet the 120-semester credit hour minimum for the bachelor's degree. Free electives may be from any discipline. Free electives are not to be confused with major or minor electives.

Full-time Status: This status designates those students who enroll in 12 or more semester credit hours.

Grade Point Average: Grade Point Average (GPA) is a number computed based on the total earned quality points (QP) divided by the total graded credit hours. A QP is a weight associated with a letter grade. For example, If the student completed two three credit hour classes, one with a letter grade of "A" (QP=4) and the other with a letter grade of "B+" (QP=3.3). The total QP, the student, earned would be 21.9 ((4X3) + (3.3X3) =21.9). The quality points are then divided by the total credit hours earned (21.9/6) to calculate the GPA 3.65.

Graduation Efficiency Index: The Graduation Efficiency Index (GEI) is an equation developed by Gillmore and Hoffman (1996) at the University of Washington to calculate the efficiency of students who graduated. The equation considers the total number of semester hours required for the program of study and the total number of attempted hours and calculates a percentage of efficiency.

Graduation Rate: The graduation rate is the portion of an entering cohort who graduated in a specified time. Graduation rates are expressed in four-year, five-year and six-year terms. Graduation rates are based on first-time, full-time freshmen and do not account for students who leave the institution or transfer into the institution (Gillmore & Hoffman, 1997).

Major: The major is the primary area of academic study.

Major Changes: The number of times a student officially changes their major with the institution.

Major Electives: Major electives are a set of courses prescribed by the major that a student must select from to meet a specific requirement. For example, a student may choose three courses to complete from a set seven prescribed courses.

Minor: A minor is a secondary area of academic study. Some programs of study require a minor; nevertheless, most minors are optional.

Minor Electives: Minor electives are a set of courses prescribed by the minor that a student must select from to meet a specific requirement. For example, a student may choose three courses to complete from a set seven prescribed courses. Minor electives are not to be confused with free electives.

Minimum Total Credit Hour Requirement: Minimum total credit hour requirement is the total credits required for the bachelor's degree program of study (general education + major requirements + minor requirements + free electives). All bachelor's degrees must have at least 120-semster credits hours. Nevertheless, some programs of study may calculate a total credit hour requirement beyond the 120-semester credit hour threshold. However, a bachelor's degree program of study cannot have less than 120-semster credit hours.

Part-time Status: This status designates those students who enroll in fewer than 12 semester credit hours.

Persistence: Persistence is progressive re-enrollment in college and progression towards a degree. Students may continuously enroll in subsequent terms, or they may take time off and resume enrollment later.

Program of Study: The program of study consists of the general education, major and minor requirements, and free electives. Program of study is often interchangeable with curriculum structure.

Retention: Retention refers to the proportion of students re-enrolling in the subsequent term. If students fail to enroll in the following term, this is often counted against retention.

Semester: The Semester is a 15-week period in which courses are offered. WSU has three semesters, fall, spring, and summer.

Time to the Degree: Time to the degree is a standard measure of efficiency in higher education. Time often begins at the point of matriculation to graduation. However, it can also be defined as time starting at the end of high school graduation to when the degree is obtained (Gillmore & Hoffman, 1996).

Transfer Student: WSU, based on their current admission standards, considers students who transferred with 30 or more credits from a regionally accredited institution as transfer students. Only participants who transferred with 30 or more credits are

considered transfer students for this study. Students who transferred with fewer than 30 credits are considered WSU native students.

Transfer Attempted Credit Hours: Total attempted hours from all transfer institutions a student has previously attended. WSU transcribes all transfer work including repeated, remedial, and failed courses. WSU, however, does not transcribe courses with a W grade.

Transfer GPA: The GPA of all transfer courses a student has completed at another institution, excluding WSU course work.

WSU Attempted Credit Hours: Total attempted semester hours at WSU, excluding transfer course work.

WSU GPA: The GPA of all WSU courses, excluding transfer course work.

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CHAPTER I

INTRODUCTION

Participation in higher education has grown six-fold in the United States over the past 50 years. In 1990, twelve million students enrolled in higher education, which is 2.3 times the number of students who were enrolled in 1965, more than six times the enrollment in 1950, and ten times than that of pre-World War II levels (Attewell & Lavin, 2007; Kena et al., 2015). In the fall of 2012, undergraduate enrollment in degree granting, higher education institutions rose to 17.7 million students, an increase of 48% from 1990, when enrollment was 12.0 million students. The National Center for Education Statistics has projected that undergraduate enrollment will increase from 17.7 million to 20.2 million students between 2012 and 2023 (Kena et al., 2014).

Federal and state governments have a stake in the productivity of higher education institutions. College graduates contribute more to tax revenues and are less likely to depend on social safety-net programs, generate decreased demand on public budgets, and are less sensitive to employment fluctuations with changing economic conditions (Baum et al., 2010; Pascarella, Terenzini, & Feldman, 2005). By 2018, the United States will need 22 million college graduates to meet the needs of the labor demand (Carnevale et al., 2010). The projections suggest that the production of college degrees (associate's degree or higher) will fall short by at least 3-million qualified workers. Also, the

workforce will require 4.7 million new workers with postsecondary certificates (Carnevale et al., 2010). This shortfall will result in lost economic opportunity.

There is a disconnect between the increase in undergraduate enrollment and the projected shortfall of qualified workers with a college credential (Carnevale et al., 2010). The growth of students compared to the deficit of skilled laborers suggest that students who enroll in an undergraduate degree do not necessarily persist to degree completion. In fact, the National Center for Educational Statistics indicates that only 59% of first-time, full-time students who began seeking a bachelor's degree at a four-year institution in fall 2007 completed the degree at that institution by 2013 (Kena et al., 2014, 2015). The students who do complete a degree are taking longer than in years past.

The length of time to complete a degree has increased. Before the 1970s, graduation rates were based on 4 year calculations. Now, 6 years is the new national standard for computing college graduation rates to capture a broader population of students who graduate. Fewer than 7% of first-time, full-time freshman enrolled at four-year institutions thought that it would take them more than 4 years to graduate with their bachelor's degree (Astin, 2002). The new six-year national standard is evidence of the changing student population and the college attendance patterns (Attewell & Lavin, 2007; Kuh, Kinzie, Schuh, & Whitt, 2011).

States have begun to take action. Through Complete College America, governors from 33 states have committed their states to confronting what they deemed as the college completion challenge. They recognize several factors challenge college completion. Namely, the majority of students are nontraditional; part-time students' graduation rates are low; poor students and students of color have low graduation rates;

remediation is producing few students who ultimately graduate; and finally, students are taking more credits than required for degree completion resulting in too much time to complete their degree (Jones, 2012).

Statement of the Problem

Policymakers at the state and national levels have identified college completion as a key policy priority (Jones, 2012; Obama, 2009). The proportion of adults with a college credential has decreased and the equity gap in college completion is expanding (Adelman, 2006; Baum et al., 2010; Bowen et al., 2009; Carnevale et al., 2010). Given this policy context, there is an interest in the extent to which degree pathways are efficient or inefficient and how these efficiencies may contribute to degree completion (Cohen & Ibrahim, 2008; Gillmore & Hoffman, 1997; Jones, 2012; Poch & Wolverton, 2005).

In this study, efficiency is examined and conceptualized based on student credit hours. National and state research shows that many students do not graduate within an expected timeframe and are graduating with more credit hours than needed for degree completion (Jones, 2012, 2014; Utah Legislature, Office of the Legislative Auditor General, 2011). For example, at public four-year institutions, only 36% of full-time students at research-extensive institutions and 19% at other four-year institutions graduate in 4 years, the expected time to degree for full-time students (Jones, 2014). Furthermore, according to Complete College America, only 50 out of 580 four-year institutions report graduation rates of students graduating in 4 years at or above 50% for first-time, full-time students (Jones, 2014). Further, Jones (2014) found that students at four-year public nonhigh research institutions, termed non-R1, graduated with 133.5

credits, on average. Yet, the standard bachelor's degree only requires 120 credit hours, resulting in 13.5 excess credits. Students at high research institutions (R1) graduated on average with 134.6 credit hours, an excess of (14.6 credits).

In Utah, however, students graduate with 6 to 10 more credits, on average, than the national average resulting in 139. 6 credit hours at non-R1 and 144.1 credit hours at R1 institutions (Jones, 2014). Given that students graduate with more credits than needed, this suggests there may be inefficiencies in the students' pathways and degree programs, and these inefficiencies have implications for students such as higher debt levels upon graduation and higher costs for the state (Archibald & Feldman, 2010).

There is little empirical evidence on the factors that contribute to excess credits and inefficiencies. Most research measures inefficiencies in degree programs based on graduation rates and time to degree (Cohen & Ibrahim, 2008; DesJardins, McCall, Ahlburg, & Moye, 2002; Gillmore & Hoffman, 1997; Johnson & Baum, 2004; Jones, 2012; Knight, 2004; Poch, 1998; Zhu, 2004). Existing research suggests that some factors, such as student characteristics, correlate time to degree. These student characteristics include demographic background, academic preparation, enrollment patterns, the need for remedial work, and financial need (Adelman, 2006; Dechter, 2009; Knight, 2004; Roksa, 2009; Roksa & Keith, 2008). Furthermore, institutional characteristics, including the curriculum structure of the program of study and the sequencing of degree requirements and course prerequisites (Johnson & Baum, 2004) also correlate to time to degree.

Nevertheless, measuring success based on time to degree does not account for factors that influence time to degree such as diverse attendance patterns. Time to degree

may also vary dramatically when one accounts for the different geographical, student, and institutional characteristics that could influence it. Using time to degree as a primary efficiency measure is flawed if factors that influence it are not accounted for in models. Studying the efficiency of degree completion through the Graduation Efficiency Index (GEI), an index that measures efficiency based on total credits required for the degree and a student's total attempted hours, or by total credits for graduation can provide a more complete picture of the path that students take to degree completion by evaluating how efficiently students are using their credit hours and can help define accountability and success of the student and the institution (Gillmore & Hoffman, 1997). The GEI used in this study is fundamentally different than time to degree because it is based on an analysis of the efficient use of credits. The GEI can parse the difference between a part-time student who is taking more time to complete their degree, but is not taking excess credit, versus a full-time student who graduates in a faster time period but has inefficient use of credit. Furthermore, the metric is able to account for student-level and institutional-level factors that may influence efficiency. Students' measure of efficiency is based on how adeptly they complete the requirements for the degree.

Largely absent from the literature on graduation inefficiencies is the extent to which the curriculum structure influences graduation efficiency. In this study, curriculum structure refers to the percentage of free elective credits (electives that apply to the minimum total credit hour requirement, but are not applicable to any general education, major or minor requirement) versus required major, minor, and general education credits. At Weber State University (WSU) and other institutions, many students graduate with more credits than needed for the major and complete program of study (Jones, 2014). The

excess credits may be triggered by the deficiency of free electives built into the program of study. Theoretically, the excess credits would increase if a student graduates in a major with little or no free electives, because free electives allow students to explore classes that may not apply to their program of study. In other words, free electives built into a program of study can absorb credits that were taken previously, but are not applicable to any major or minor requirements. Among different programs of study, there is large variation in the proportion of free electives, and research has not considered whether this key structural factor relates to students' degree efficiency.

Why Efficiency?

Efficiency, based on the most basic definition, is the comparison of inputs versus outputs (Coelli, Rao, O'Donnell, & Battese, 2005). Efficiency, in the context of this study, is focused on the input, the total and type of credits required to complete the prescribed program of study verses the output, the total and type of credits a student used to complete the program of study. In other words, efficiency is the comparison of what is actually produced with what can be achieved with the anticipated consumption of resources.

Studying efficiency in education is a fascinating and complex endeavor. On the one hand, students should have the opportunity to explore and gain as much knowledge in an environment that supports their scholastic goals (Kuh et al., 2011; Pascarella et al., 2005). The purpose of education is not simply to consume knowledge but to expand the mind, engage in enriching educational experiences, discover the self, and prepare to be a productive and contributing member of society. On the other hand, the money and time spent to complete courses or engage in experiences that do not contribute to degree

progression can have a negative effect on the students' economic opportunity (Archibald & Feldman, 2010; S. Jones, 2012). For example, one of the largest costs of higher education is the opportunity cost of their time (Mincer, 1974). Opportunity cost is an economic phrase. A simple definition is the cost you incur by doing one thing rather than another. For each year that a student spends enrolled in classes, that person gives up about $9,000 income that could have been earned had he or she been gainfully employed. The cost rises to $15,500 for the students who do not work (Bowyer, 2014). Furthermore, inefficient degree pathways may cause a strain on limited institutional resources and may increase the cost of education, particularly the cost of public subsidies that come from state and federal taxes (Archibald & Feldman, 2010; S. Jones, 2012). Because they are responsible for using taxpayer dollars, policymakers and leaders who are responsible for taxpayer dollars have an incentive to develop and implement policies that are not inefficient.

Studying efficiency is a complex endeavor because of these competing purposes and goals of higher education. Enhancing student's choices, experiences, and potentially their time to degree can be critiqued because it may lead to inefficiencies and lack of degree completion. Alternatively, policies and practices that privilege efficiency can be critiqued for curtailing students' opportunity to explore have rich educational experiences, and potentially negatively influence equity (Bowles & Gintis, 2011).

The purpose of this study is not to address this debate or settle it, nor is it to argue that efficiency is a more important or relevant goal. Rather, it is to use a more nuanced and robust measure of efficiency that addresses the various factors that influence the outputs of students' educational experiences, as well as assess what factors influence

students' efficiency. Further, although GEI is a quantitative metric of efficiency, this study does not support a norm for what a student's GEI should be. Rather, this should be an institutional discussion and decision that is considered within a larger institutional and student context. This study contributes by using a conceptual framework that can help an institution structure a problem, which is the first step in policy analysis.

Conceptual Framework

The conceptual model guiding this study uses a policy analytic lens as a multidisciplinary inquiry design to produce relevant information to solve complex problems (Dunn, 2012). Policy analysis is a problem-solving discipline. Policy analysis is not confined to one field of inquiry, but rather it draws from various areas of the social sciences, economics, and other research methodologies (Dunn, 2012).

Dunn argues that in order to formulate sound policy, it is imperative to define the right problem to both develop a policy solution and to measure the effectiveness of the policy. Therefore, to understand the elements of the problem it is critical that available research and evidence yield reliable information. Five types of policy-relevant information are produced and transformed by using policy-analytic methods: problem structuring, forecasting, prescription, monitoring, and evaluation (Dunn, 2012). All five methods employ judgments of different kinds: (a) to accept or reject an explanation, (b) to affirm or dispute the rightness of an action, (c) to prescribe or not prescribe a policy, (d) to accept or deny a prediction, and (e) to formulate a problem in one way rather than another (Dunn, 2012; O'Shaughnessy, 1972).

This study will use the problem-structuring method to produce information about which "problem situations" (e.g., demographics, precollege characteristics, transfer,

academic characteristics, and curriculum structure) influence the GEI. Problem-structuring is the first step in policy analysis. The problem-structuring process is designed to produce information about "problem situations" (Dunn, 2012). The information generated from studying the "problem situations" can then be used to define and structure the problem. Once the problem is defined, future research can be designed to evaluate potential solutions to the problem. For example, administrators and researchers sense there is a problem with degree efficiency, this first step is known as problem-sensing. They want to understand what influences degree efficiency and have a supposition that curriculum structure may have a large influence on degree efficiency. Curriculum structure in this example is a problem situation. To understand what contributes to the problem of degree efficiency, the problem-structuring process is employed and research is conducted to produce reliable information about the "problem situations" or variables that have a statistically significant effect on degree efficiency.

Purpose of the Study

Demographics, precollege academic characteristics, transfer information, academic characteristics, and curriculum structure are among several factors that may affect degree efficiency and are the primary foci of this study. Using Dunn's framework, these variables are characterized as problem situations. In the context of policy analysis, problem situations are not problems; problems are a representation of problem situations (Dunn, 2012). Identifying and evaluating problem situations can lead researchers and policy analysts to structure the problem for which a solution needs to be developed.

The purpose of this dissertation is to employ problem-structuring methods (Dunn, 2012) to uncover problems on the pathway to degree attainment for students who

graduated from Weber State University, a large public university in the Ogden metropolitan area in Utah. The study utilizes the Graduation Efficiency Index (GEI) as a measure of degree efficiency. The GEI is an equation developed by Gillmore and Hoffman (1997) at the University of Washington. The equation considers student credit hours as the unit of measurement. The GEI equation calculates the student's total attempted hours, (all earned, failed, withdrawn, and repeated credits), divided by the total credits required for the program of study. The GEI represents a percentage of how efficiently a student completed their degree. For instance, a student who graduated with 130 attempted hours in a program of study that required 120 credits would have a GEI of 92.3%.

There is little research on what factors influence the efficiency of graduation pathways. The purpose of this study is to address the problems defined above by analyzing bivariate relationships with the GEI and conducting a hierarchical multiple regression analysis while using policy-analytic methods as a conceptual framework (Dunn, 2012) to evaluate the complexity of the problem and determine what factors influence degree efficiency.

The purpose of this study is not to define or determine an efficiency threshold. Rather, this study will identify which variables will positively or negatively affect the GEI. Administrators, analyst and researchers can use this information to formulate problems and develop policy solutions to mitigate difficulties that have a negative effect towards the GEI.

Research Questions

The following research questions guide this study.

1. What is the bivariate correlation among the GEI and:
    a. demographic and precollege academic characteristics (i.e., gender, age at graduation, race/ethnicity, dual enrollment programs, entry GPA, and Pell grant eligibility),
    b. student transfer and academic characteristics (i.e., transfer students, number transfer institutions, the number of major changes, transfer associate degree, WSU associate degree, failed a course, withdrew from a course, remedial course, repeated a course and GPA at graduation), and
    c. curriculum structure (percentage of free electives in the program of study)?
2. Do demographic and precollege academic characteristics predict degree efficiency?
3. Controlling for demographic and precollege academic characteristics, do transfer and academic characteristics predict the GEI?
4. Controlling for demographic, precollege academic characteristics, transfer and academic characteristics, does the curriculum structure predict the GEI?

These general questions are further disaggregated for specific analyses and presented in Chapter 3.

Significance

The policy-analytic methods applied to the study of graduation pathways will enable administrators to unpack critical issues that affect degree completion at WSU. The

results of this study will expand the knowledge and insights about the efficiency of graduation pathways and provide administrators, academic planners, as well as higher education researchers a better understanding of how to develop policies that will improve efficiency of the graduation pathway, reduce excess credit hours at graduation, and ultimately, increase degree completion.

Moreover, this study will begin to unpack the complexity of the graduation pathway by gathering information on variables that may affect efficient pathways. The problem-structuring methodology will help researchers and administrators ascertain how each variable influences the GEI, which will help them understand which issues to address as well as encourage further research and improvements in policy and practice.

Another significant contribution of this study is that it quantitatively examines curriculum structure and the effect on degree efficiency. Existing research has not accounted for the distribution of curriculum requirements and how students' completion of various requirements influences their pathway to degree completion. The results can produce valuable information to faculty and administrators who are creating new programs and how to balance requirements in the major, minor, general education, and free electives. The results are also important to institutions as they seek to revise existing programs to support student success. Institutions are facing increased pressure to adopt and adapt policies to support student success, including policies that reduce curriculum requirements (Haffner, 2017). Having adequate data and information to inform curriculum decisions is critical to advancing effective and sustainable policy solutions.

This study also examines the effect of transfer status and earning an associate's degree on bachelor's degree efficiency, two factors commonly attributed to inefficient

pathways. Indeed, several studies have examined the influence of student transfer and transfer policies on bachelor's degree completion within a specific time frame, but none have accounted for credit use (Poch & Wolverton, 2005; Roksa & Keith, 2008; Wellman, 2002). The findings can enhance our understanding of how transfer and transfer policies influence student success using a more robust efficiency measure and can inform improvements to transfer and articulation policies.

The focus of this study on excess credits and efficiency is significant because the price that students and families pay for higher education is increasing as is student loan debt, the average Class of 2016 graduate has $37,172 in student loan debt, up 6% from last year (Archibald & Feldman, 2010; Federal Student Aid, 2017). This study has the potential to identify ways that institutions can better understand inefficiencies that may lead to policy and practice decisions that save students and families money.

CHAPTER II

LITERATURE REVIEW

Chapter 2 provides a review of literature related to individual and societal benefits of a college degree and college impact and retention theory. In addition to a consideration of different methods of studying degree attainment, the review of literature will include findings from other researchers on graduation rates and time to degree completion. This chapter will likewise examine the relationship of demographic and precollege academic characteristics and degree completion. Furthermore, the literature will examine student transfer and academic characteristics. Finally, an examination of problem structuring will be used to identify which problem situations contribute to inefficient degree completion.

Numerous variables can influence whether or not a student will earn a bachelor's degree and how efficiently they will complete the degree. The institution can affect some variables. Nevertheless, many variables relate to the individual student. If students at all institutions had all the same characteristics, comparing graduation efficiency rates of institutions would be easier. However, students have different backgrounds and experiences that may affect institutional graduation rates. Research on this topic should realize various types of institutions attract various types of students for a variety of reasons (Blose, 1999; Pascarella et al., 2005).

Individual and Societal Benefits of a College Degree

Higher education is considered the great equalizer in the United States. Early status attainment literature suggests that higher education matters to intergenerational status attainment and social mobility (Blau & Duncan, 1967). Through education, it does not matter what economic stratum a person is born into, he or she can develop the skills necessary to succeed (Seidman, 2005). The nation's economy depends in part on the educational attainment of its citizens.

In a technological society and with the advent and the ever-increasing utilization of the Internet and other forms of communication and commerce, it has become requisite that we continually hone and enhance our skill set if we want to remain knowledgeable and competitive (Seidman, 2005). At a skill level necessary to advance our country, our nation needs skilled workers in mathematics, quantitative reasoning, and the sciences. (Anderson & Kim, 2006; Chen 2009; Dowd, Malcom, & Bensimon, 2009). An educated society provides precious human capital to a nation that cannot be wasted. It is, therefore, imperative that society continue cultural and intellectual growth.

A college education, by some, is regarded as a private good (Marginson, 2007). However, federal and state governments realize how meaningful education is to the validity and success of our country. State and local governments appropriate billions of dollars each year for public colleges and universities and the federal government provides grants, loans, and work assistance, as well as tax credits and deductions, to help students finance their education (Baum et al., 2010).

Colleges and universities grant students the opportunity to obtain a broad range of personal, financial, and other lifelong benefits. Equally, when citizens access higher

education, taxpayers and society derive a host of direct and indirect benefits. Higher levels of education correlate with lower unemployment and poverty rates (Baum et al., 2010; Pascarella et al., 2005). Adults with higher levels of education also contribute more to tax revenues and decrease demand on public budgets, because they are less likely to depend on social safety-net programs (Baum et al., 2010).

Higher education benefits to individuals are both monetary and nonmonetary. There is a positive correlation between higher levels of education and higher earnings for all racial/ethnic groups and men and women. Furthermore, college graduates are more likely than others to enjoy employer-provided health insurance and pension benefits (Baum et al., 2010; Pascarella et al., 2005). In 1971, both male and female bachelor's degree holders had an average annual earnings advantage (adjusted for inflation) of 48.5% over those who only hold a high school diploma (Pascarella et al., 2005). In 2007, the typical bachelor's degree recipient can expect to earn about 61% more than the average high school graduate (Baum et al., 2010). It is reasonable to conclude that the premium to bachelor's degree had increased in the twentieth century (Boesel & Fredland, 1999; Bound & Johnson, 1989; Freeman, 1994; Grogger & Eide, 1995; Katz & Murphy, 1991; Levy & Murnane, 1992; Murphy & Welch, 1993; Pencavel, 1991).

There are considerable nonmonetary benefits of a college education, which includes better health and greater opportunities for the next generations (Baum et al., 2010). Bachelor's degree attainment significantly increases the likelihood of entering relatively high-status managerial, technical, and professional occupations, which increases not only earnings but also job stability. Therefore, college graduates are less sensitive to employment fluctuations due to changing economic conditions (Baum et al.,

2010; Pascarella et al., 2005). Furthermore, college imparts cognitive skills, values, attitudes, and behavioral patterns that prepare individuals to be more productive in complex technical, professional, and managerial occupations and, therefore, more highly paid (Pascarella et al., 2005). Beyond the salary benefits, college graduates are less likely to be dependent on social and public assistance programs, are healthier and benefit from employer-paid pensions and health insurance. Moreover, college graduates are more apt to engage in their community by participating in organized volunteer work, take an interest in voting and the political process, and are more liable to donate blood. Additionally, college-educated adults are more apt to be open to different points of view, and the children of college-educated adults tend to have higher cognitive abilities and are more likely to engage in cultural, athletic, and religious activities (Baum et al., 2010; Pascarella et al., 2005).

The overall benefit of obtaining a degree is substantial both to the individual and to society. Earning a college degree is not easy. Furthermore, students are faced with many challenges along the way that may postpone their progress or prevent them from receiving a degree. The attrition and retention of students in higher education is important. Many researchers have studied and continue to explore college impact and retention theory (Astin, 1970a, 1970b, 1993; Braxton, 2000; Pascarella, 1985; Seidman, 2005; Tinto, 1975, 1987; Weidman, 1989). It is important that college impact and retention theory be touched upon; however, it is not the central tenant of this research. The focus of this research is for those students who have persisted to degree obtainment. Nevertheless, this research is concerned with the efficiency at which the student obtains their degree. These findings may lead to insights that might help us better understand

college impact and retention theory. Nonetheless, it is felicitous to cover briefly college impact and retention theory.

College Impact and Retention Theory

For over 70 years, college impact and retention theory research has been debated and studied (Braxton, 2000). However, the greatest progress has taken place in the last four decades, with the promulgation of Tinto's Internationalist Theory (1975). Researchers have conducted studies using economics (Cabrera, Stampen, & Hansen, 1990; St. John & Noell, 1989), organizational (Bean, 1980, 1982), psychological (Brower, 1992; Stage, 1989), and sociological (Rootman, 1972) theoretical perspectives. Nevertheless, it was Tinto's internationalist theory of college student departure that had the greatest influence on how we view retention theory (Braxton, Hirschy, & McClendon, 2011). The testing of Tinto's theory resulted in a deeper understanding of student retention. There are limitations to Tinto's theory, and a full understanding of student retention remains enigmatic.

Alexander Astin (1970a, 1970b, 1991), whose work preceded Tinto's student departure theory, proposed one of the first college impact models more familiarly known as the input-environment-outcome (I-E-O) model. Astin's model suggests that college outcomes are functions of three points: a) inputs, what the student brings with them to college; b) environment, the interactions and experiences a student encounters in college; c) and outcomes, the students' characteristics, beliefs, knowledge, skills and values that exist after college. Astin (1984, 1985, 1991) attributes the institutional environment as a critical role in how it affects change in students.

Tinto extended Spady's (1970) work on connecting Durkheim's (1951) theory of

suicide to the study of college student persistence. Tinto agreed with Spady's model that the more academically and socially involved students are on campus, the more likely they are retained (Andres & Carpenter, 1997; DesJardins, Kim, & Rzonca, 2003; Valentine et al., 2011). Tinto suggested that various individual characteristics (e.g., family background, personal attributes, and precollege schooling experiences) that students exhibit as they enter college directly influence their decision to persist or leave college. Furthermore, he suggested that academic and social integration impact student's ensuing commitment to the institution and persistence to graduation (Tinto, 1975).

College impact and student retention theory share several characteristics. There are prominence and particular roles assigned to the context in which a student acts and thinks. The institutional environment, including the structure, programs, and services as well as the attitudes, values and behaviors of others who occupy the space in the environment have potential to influence the impact of the student's success and commitment to the institution. Students who have successfully obtained a bachelor's degree may have found a way to interact with the institutional environment. Nevertheless, degree completion does not necessarily mean that students did not encounter difficulties and inefficiencies that can be attributed to their precollege characteristics and the institutional environment. It is important to identify what variables do contribute to efficiency along the degree pathway. Increasing efficiency may support an environment that would encourage greater commitment to the institution and graduation. It is, therefore, important to study the degree pathway.

Degree Attainment

As previously mentioned, it has been established that many are interested in degree completion (Anderson & Kim, 2006; Baum et al., 2010; Chen 2009; Dowd et al., 2009; Pascarella et al., 2005). The impact of college and the retention of students is enigmatic and requires further study (Astin, 1970a, 1970b, 1993; Braxton, 2000; Pascarella, 1985; Seidman, 2005; Tinto, 1975, 1987; Weidman, 1989). We know that access to and success in college as well as transferring from one institution to another are the product of a complex set of factors. Some elements can be traced back to the eighth grade. Others factors pertain to the institutional environment (Braxton, 2000; Cabrera & La Nasa, 2000; Hossler, Schmit, & Vesper, 1999; McDonough, 1997; Paulsen & St John, 2002).

It is necessary to examine literature that addresses measuring degree attainment efficiency. There are many methods to study degree attainment efficiency. Moreover, different states and organizations use different methods to attribute accountability and measure student or institutional success, as it relates to degree attainment efficiency. Frequently, graduation rates, time to degree, and total credit hours towards a degree are used as measurements. However, more recent measurements of degree attainment efficiency are the Graduation Efficiency Index (GEI) and institutional graduation efficiency. Addressing all measures of degree attainment is appropriate. This study, however, is focused on degree attainment efficiency based on total credit hours. Notwithstanding, it is central to this study to parse out variables that disrupt degree attainment efficiency using the problem-structuring methodology. Therefore, a review of different degree attainment efficiency measures will be assessed.

Graduation rates

Graduation rates are a measure of the share of students who enter college and graduate within a certain number of years (Cook & Pullaro, 2010). State and federal policymakers are encouraging college graduation to increase economic benefits. Additionally, graduation rates are also used as a mechanism to push for accountability from college and universities. The Utah State Board of Regents identified college graduation as a strategic priority in 2005, and in 2010, a national movement, known as Complete College America, was formed to encourage state policies to improve graduation rates (Jones, 2012; Utah Legislature, Office of the Legislative Auditor General, 2011). There are, however, several factors to consider before using graduation rates as a measure of institutional success.

The National Collegiate Athletic Association (NCAA), in 1985, was the first organization to begin reporting on graduation rates to compare the academic records and performance of student athletes with the overall student body (U.S. General Accounting Office, 1989). However, these records were not available to the public and were only shared among NCAA member institutions that provided the data. Later, U.S. Senators Bill Bradley and Edward Kennedy, in 1988, proposed Senate Bill 2498, known as the Student Athlete Right-to-Know Act (Bradley, 1990). The bill required all institutions that received Title IV funding to submit an annual report to the Secretary of Education containing information on graduation rates. The motivation of the legislation was to provide necessary and relevant information for the student-athletes to make an informed choice concerning which college to attend. In 1990, Congress passed the Student Right-to-Know and Campus Security Act. Congress believed that the data collected on

graduation rates would be useful to all students making college choice decisions (Bradley, 1990).

Graduation rates are increasingly becoming a significant part of the accountability conversation at higher education institutions. There are several data sources to calculate graduation rates. However, only a handful of data sources can be used to calculate graduation rates at the national level. Each database is slightly different regarding who is included in the graduation cohort to calculate graduation rates. Therefore, depending on the data set, different graduation rates are likely. Because of the different methodologies, each database has advantages and disadvantages in calculating national graduation rates. Moreover, not all databases can generate institutional-level graduation rates. The databases that produce institutional level data include Integrated Postsecondary Education Data System (IPEDS), the National Student Clearinghouse (NSC), and State Data Systems. The databases that do not produce institutional level data include Beginning Post-Secondary Student (BPS) Study, and National School-to-College Longitudinal Studies (i.e., National Longitudinal Survey (NLS), High School and Beyond (HS&B), National Education Longitudinal Study (NELS), Education Longitudinal Study (ELS) and High School Longitudinal Study (HSLS).

Unfortunately, no single database can calculate annual, comprehensive graduation rates for all institutions or students enrolled in higher education. Furthermore, IPEDS Graduation Rate Survey (GRS), which is arguably the database most frequently used to calculate graduation rates, estimates institutional graduation rates that exclude at least 48% of enrolled students. As a result, IPEDS GRS is often criticized as an incomplete source of data (Cook & Pullaro, 2010). Therefore, the current databases are limited and

inadequate in fully measuring an institution's graduation rate against a national benchmark and may not accurately portray the quality and effectiveness of the institution, let alone any measure of efficiency.

Grounding the efficiency standard, as an institution, on graduation rates is problematic. "Current definitions of retention and graduation rates distort the picture of student success by limiting it to completion of a degree at the institution of entry" (Jones-White, Radcliffe, Huesman Jr, & Kellogg, 2010, p. 154). Graduation rates are misleading in that the underlying assumption is that students enroll in one institution and complete their degree. Furthermore, graduation rates assume that students are continuously enrolled. Graduation rates do not reflect the minutiae of the enrollment patterns of today's students. Many students have erratic attendance patterns and stop and start their higher education experience. "The changing patterns of college attendance have, over time, eroded the value of graduation rates" (Cohen & Ibrahim, 2008, p. 52). Moreover, a significant number of college students have attended more than one institution. Students who transfer can have an adverse impact on graduation rates for the first institution and are considered a failure in the graduation rate. Furthermore, transfer students do not count in the graduation rates of the degree granting institution (Attewell & Lavin, 2007; Capaldi, Lombardi, & Yellen, 2006).

Astin (2005) suggested, "an institution's degree completion rate is primarily a reflection of its entering student characteristics, and differences among institutions in their degree completion rates are mostly attributed to differences among their student bodies at the time of entry" (p. 7). Comparing graduation rates is more complicated than initially thought. The graduation rate breaks down when comparing rates of different

institutions. The comparison infers that the difference in graduation rates is attributed to the characteristics of the institutions and does not account for the differences between the students and the mission of the institution. Howard and Rodgers (1991) articulated the issue as such:

> Comparison of retention and graduation rates between institutions is problematic because institutions differ in their educational philosophies and missions. Institutions with an open-door admissions policy, whose mission is to provide educational opportunity to all applicants within a certain region or have certain characteristics, will probably have retention and graduation rates different from those of college and universities with selective admissions standards. Institutions that serve adult and nontraditional students will have retention and graduation rates different from those of institutions that serve the traditional college-aged populations (pp. 68-69).

For a comparison to be equitable, differences in the institution's mission and student population must be considered. The challenge then lies in researchers only comparing institutions that are equally selective or finding a way to relate one institution to another, regardless of the characteristic differences (Blose, 1999).

Time to degree

Time to degree is another way to measure degree attainment. Time is money. Throughout our social narrative, this simple statement is heard. When it comes to college completion, the statement could not be truer. Historical data suggest that time is the enemy of college completion: the longer it takes to graduate, the less likely a student is to complete their degree. Additionally, more time on campus means more money spent on college, adding high costs as another cause for student drop out (Jones, 2012).

A college education yields greater revenue streams for the individual and society. According to human capital theory, a more educated workforce yields more economic productivity, which in turn significantly benefits society (Mincer, 1974). Jacob Mincer

(1974) suggested that the abilities and skills of an individual, especially those skills obtained through the investment in education and training, enhance potential income earnings and benefits to society. Moreover, the human capital theory argues that college graduates have more desirable jobs and earn more than high school graduates because postsecondary education provides the college graduate with marketable skills and abilities relevant to job performance (Pascarella et al., 2005). An inefficient degree pathway will increase the time to degree completion. Earning potential is postponed while the student is pursuing their degree.

Time to degree completion is a measurement of the efficiency of degree attainment. Traditionally, for a bachelor's degree, students should complete their degree in 4 years. This timetable requires students to take at least 15-semester credits for the fall and spring semesters, excluding summer. In other words, students must complete at least 30-semester credits per academic year in order to graduate within 4 years. This type of measurement warrants the opportunity to measure different students on the same plane, both native students, a student who begins and finishes at the same institution and transfer students, a student who has attended more than one institution (Poch, 1998; Poch & Wolverton, 2005). Conversely, institutions' student attendance patterns are increasingly becoming more diverse. Many students are choosing paths that are more nontraditional. Notably, they are enrolling in distance education programs, enrolling part-time (less than 12 semester credit hours) to attend to family obligations and work, and are taking advantage of online course offerings (Hagedorn, 2010; Levin, 2008; Malcom, 2012, 2012; Phillippe & Sullivan, 2005).

This study, however, is using total credit hours at graduation as a measure of

efficiency. Measuring students based on time, rather than credit hours, does not adequately measure all inefficiencies in the degree pathway. It is true, nonetheless, that the increased time to degree completion is an indication of an inefficient path. It does not, however, account for excess credit hours at the point of graduation (Gillmore & Hoffman, 1997).

Interruptions in attendance, not continuously enrolling in fall and spring semester, will significantly affect time to degree completion. Students may stop-out for a variety of reasons. Some stop-outs are for personal reasons (i.e. health, family obligations, financial difficulty), and other stop-outs may be of an academic nature (i.e., academic standing issues, disciplinary). Howard and Rodgers (1991) suggest it is important when comparing time to degree and graduation rates, to separate students who continuously enroll from students who stop-out. Logic would indicate that students who continually enroll in school would graduate sooner than students who had an interrupted attendance pattern. Nevertheless, it is difficult to deconstruct problem situations related to time to degree and graduation rates when these populations are combined. When these populations are compared separately, against aggregate data, a complete picture of time to degree and graduation rates are visible (Gillmore & Hoffman, 1997; Howard & Rogers, 1991; Poch, 1998).

Poch (1998) suggested that studying time to a degree could provide university administrators with a picture of the resources a student uses while enrolled. The logic suggests the longer a student attends an institution the more resources they use. The institution then can balance resources among all students based on degree path patterns. However, time to a degree does not necessarily directly translate to workload and

resources used by the student. Time to degree is partly dependent on the total number of credit hours a student attempts, in addition to the course load per semester and the continuum of the attendance pattern. Credit hours are a measure of workload and resources in institutional budgeting (Wellman, 2003). The credit hours students attempt will translate into use of resources and time spent at the institution. Attempted hours include courses used towards a degree and elective requirements, and also failed, withdrawn and repeated courses.

One of the designs and purposes of the credit hour was to create an activity measure that could be used to normalize costs and compare production costs across institutions (Barrow, 1990; Shedd, 2003). The student credit hour has "evolved into one of the most important elements for public budgeting, both as a building block for student enrollments and as an analytic tool for assessing how resources are used, through cost measurement and analysis of student workflow" (Wellman, 2003, p. 84). Thus, we see time to degree as a measurement of efficiency falls short on identifying problems situations that contribute to excessive credit at graduation and inefficient degree pathways.

Graduation efficiency index

To measure the graduation efficiency of students at the University of Washington (UW), Gillmore and Hoffman (1997) developed an equation they termed as the Graduation Efficiency Index (GEI). They argued that time to a degree measured in calendar years from the point when a student matriculates to graduation is not a valid measurement of efficiency and cannot measure the utilization of resources. Time to degree methodology accounts for the lapse of time in either the calendar year or academic

units (i.e., semesters or quarters), whereas, the GEI considers student credit hours as the unit of measurement. The GEI equation calculates the student's total attempted hours, (all earned, failed, withdrawn and repeated credits), versus the total credits required for graduation (120-semester credit hours). Therefore, a student who completed a 120-credit hour bachelor's degree with exactly 120 attempted credit hours is deemed to be 100% efficient. The efficiency calculation, however, does not account for the length of time for degree completion. Thus, a student who graduates in 4 years with a 120-semester credit hour bachelor's degree, who has 140 attempted credit hours, would calculate at an 85% efficiency rate (Gillmore & Hoffman, 1997; Lam, 1999; Poch, 1998; Poch & Wolverton, 2005; University of Washington, Provost's Committee on Accountability, 1997; Washburn & Priday, 2003).

Inefficient graduation pathways indicate an inefficient use of instructional resources. State governments demand fiduciary accountability for public higher education institutions. Much of the accountability is a measure of graduation efficiency, graduation rates, and time to degree. Balancing resources and effectively managing the cost of instruction are common challenges for colleges and universities. Cost refers to the value used to produce a good or service. Colleges and universities receive subsidies, from state appropriations for state-supported institutions and gifts and endowment income for private institutions. These subsidies allow institutions to charges prices (tuition and fees) that are often less than the instructional costs (Archibald & Feldman, 2010). For many industries, the distinction between cost and price is of little consequence. The price is set a bit higher than the cost of labor and other resources to earn a profit. Higher education, however, is different. The price (tuition and fees) is set lower than the instructional cost.

Subsidizing the cost of education with local and federal government funds puts a magnifying glass on the higher education industry. The GEI provides a measurement of how efficiently students are using instructional resources.

The majority of costs associated with graduation efficiency are related to instructional cost and not student service expenditures. "The amount of instructional space a student consumes contributes significantly to the cost of education independent of the calendar time it takes him/her to graduate. Thus, calendar time may not be a valid measure of efficiency" (Gillmore & Hoffman, 1997, p. 679). Graduation rates or time to degree cannot measure the efficient utilization of the cost of instruction. The GEI is arguably a better measure of degree attainment efficiency (Gillmore & Hoffman, 1997).

Calendar time from matriculation to graduation as an accountability measure may have unintended negative consequences, which also causes validity problems. Degree efficiency measured in calendar time assumes that students are continuously enrolled full time and does not account for part-time enrollment. (Gall, Borg, & Gall, 1996; Messick, 1994). Gillmore and Hoffman (1997) suggest that a more appropriate measure is the amount of instructional space that a student occupies over the course of his or her studies. Furthermore, they advocate the GEI measurement is more defensible because it takes into account multiple variables. Several variables are used to calculate the GEI. What follows are the variable definitions:

1. Total earned credits hours. Credit hours that are completed and count towards the total 120 minimum credits for the degree. Earning more credits than required for the degree reduces efficiency.
2. Total credits of withdrawn courses. Courses that a student has withdrawn from

after the census date. These courses are typically withdrawn after the third week of instruction leaving no opportunity for another student to fill the empty seat, which adds to inefficiency.

3. Total credits of repeated courses. Repeated courses are courses that a student took and then retook the course later. The repeated course is excluded from the GPA and cannot count towards total credit hours. Students essentially fill the same seat twice.
4. Total credits of failed courses. Failed courses are courses that a student took and received a failing grade or a course that a student took, stopped attending, and did not withdraw. The result is an unofficial withdrawal, which functions as a failing grade. These courses cannot be used to fulfill requirements or count towards total credit hours.
5. Total credits required by the program of study. Bachelor's degrees require a minimum of 120-semester credit hours. However, some degrees may require more credit hours than the minimum. Degrees that require more than the minimum do not necessarily add to inefficiency.
6. Total credits transferred. Courses that a student has taken at another institution and transferred to the degree granting institution. Prior work needs to be recognized but not credited to the degree granting institution.

The equation developed by the UW (1997) and Gillmore and Hoffman (1997) to compute the GEI for each graduate is as follows:

$$GEI = \frac{\text{(Minimum Required Credits for the Degree – Transfer Credits)}}{\text{Sum of Enrollment Census Day Credits}} \text{ X } 100 \qquad (1)$$

The denominator for the GEI is the sum of enrollment census day credits. For the UW, this date is the tenth day of each quarter. They chose this date for two reasons. First, it is a period after which a student dropped their class it was less likely to be filled by students. Second, it was the official day for reporting enrollments (Gillmore & Hoffman, 1997; Poch, 1998; Poch & Wolverton, 2005; University of Washington, Provost's Committee on Accountability, 1997; Washburn & Priday, 2003). This date will not be the same for every institution. An alternate denominator would be total attempted hours.

Total attempted hours are the sum of all credits the student has enrolled in over the course of his or her career. At WSU, the first fifteen business days of the semester are a cancelation period. Students are allowed to cancel their course, and it will not appear on the transcript or in the attempted hours. After the cancellation period, students may withdraw from a course. However, the withdrawal will count in total attempted hours but not affect the grade point average or count towards total hours. Repeated and remedial courses also will count in total attempted hours. Remedial courses are numbered below freshman level courses (numbering 1000) and may not be used towards the total 120 minimum credit hour requirement or fulfill general education, major or minor requirements, but count in total attempted hours.

The numerator is the required credit for the degree minus total transfer credit hours. Transfer credits are those credits a student has completed at another institution and have been accepted at the degree granting institution. The minimum required credit for the degree is the summation of required credits for a degree. The minimum for a bachelor's degree is 120-semester credit hours. However, some degrees may require more credits than the 120-semester hours. Nevertheless, most degrees range from 120-semester credit

hours to 126-semester credit hours.

The quotient is multiplied by 100 to get the GEI percentage. The higher the percentage results in greater efficiency for that student (Gillmore & Hoffman, 1997; Lam, 1999; Poch, 1998; University of Washington, Provost's Committee on Accountability, 1997; Washburn & Priday, 2003).

There are two ways to evaluate transfer credits, which lead to somewhat different results. The GEI equation, as defined above, subtracts transfer credit from the numerator. "The implication of this choice is that the efficiency at the sending institution is estimated by the efficiency at the graduating institution and is weighted by the relative number of credits taken both places" (Gillmore & Hoffman, 1997, p. 682). The alternative method is to add transfer credit to the denominator. This approach Gillmore and Hoffman suggests, assumes a 100% efficiency of the transfer work completed at the previous institutions. Specifically, it considers all transfer work completed contributed to graduation, there are no withdrawn courses, repeated courses, and no courses were unnecessary for fulfilling graduation requirements. This methodology assumes all inefficiency is manifest at the degree granting institution (Gillmore & Hoffman, 1997).

Gillmore and Hoffman (1997) empirically found the alternative method rendered the efficiency index of transfer students almost the same as native students. Nevertheless, mathematically transfer students calculate as less efficient with the initial equation. However, Gillmore and Hoffman's approach is completely based on the articulation and transcription business practices at UW. It is plausible to determine an efficiency measure at the transfer institution if the receiving institution transcripts remedial, repeated, and withdrawn courses.

- Alternative Method:

$$GEI = \frac{\text{Minimum Required Credits for the Degree}}{\text{(Sum of Enrollment Census Day Credits + Total Attempted Transfer Hours}} X\ 100 \qquad (2)$$

Research, however, has shown that transfer student pathways are far from efficient (Roksa, 2009; Roksa & Keith, 2008). Therefore, the GEI method is dependent on the business practices of the receiving institution. If the business practice is not to transcript remedial, repeats, and withdrawals then the initial equation is preferred because of the empirical evidence that the alternative method overestimates the efficiency of transfer students. However, if the business practice of the institution is to transcript remedial, repeats, and withdrawals then the alternative methods is preferred. Weber State University's business practice includes the transcription of remedial and repeated course work, but not courses that were withdrawn. Therefore, WSU would be better served to opt for the alternative method.

Gillmore and Hoffman (1997) claim that the GEI has a number of advantages over traditional efficiency measures: (a) the GEI range is from zero to 100%, and the average reader and consumer is familiar with percentages and can understand them; (b) where there are a minimum number of credit hours required for a degree, GEI can evaluate degrees at different levels (i.e., AS, AA, AAS, BS, BA, BM, MS, PHD); (c) the GEI can be used to evaluate different intensities of attendance, both students who attend full-time and part-time; (d) the GEI can be averaged to compare various groups of students or degree programs. The calculation can be used as a dependent or correlative variable. Specifically, research can be conducted that examines native versus transfer students, students across academic departments or students in different programs of study; and (e) the GEI can be tracked longitudinally to assess effects of policy change

The GEI is not without limitations. The authors of the GEI recognize that it is not a perfect instrument (Gillmore & Hoffman, 1997; Poch, 1998). The purpose of the GEI is to study the efficiency of students who have graduated. For students who are progressing through their program of study, the retrospective nature of the instrument does not, by itself, adequately identify problem situations that affect efficiency. The instrument also falls short at evaluating the effectiveness of graduation rates. Nevertheless, it is a better tool to assess the use of institutional resources than time to a degree. It also lacks the ability to determine the efficiency of transfer students' pathways at their previous institutions. However, the GEI has value, when used in conjunction with other variables.

Gillmore and Hoffman (1997) used the GEI as the dependent variable and as a correlational measure. They found that students who pursued a Bachelor of Arts (BA) degree were more efficient than students who pursued a Bachelor of Science (BS) degree. They also studied students who transferred. Their findings suggest that transfer students were less efficient than native students were. Moreover, a student who transferred into a BS degree were significantly less efficient than students who transferred into a BA degree. Gillmore and Hoffman's study was the beginning of evaluating degree efficiency. However, their study fell short of identifying variables that contribute to the overall problem of efficiency along the student pathway.

Variables That Affect Graduation Efficiency

Graduation efficiency is a problem. A well-structured problem, however, is a representation of problem situations (Dunn, 2012). Several problem situations may impact graduation efficiency. Researchers have identified numerous variables that affect graduation efficiency. Some variables are related to student characteristics, while others

are linked to the institution (Adelman, 2006; DesJardins, McCall, et al., 2002; Knight, 2004; Lam, 1999; Volkwein & Lorang, 1996; Zhu, 2004). Nevertheless, student characteristics have shown to have a greater impact on graduation efficiency than institutional characteristics. Student characteristics may include demographic background, academic preparation, and enrollment patterns (changing majors, transferring, stopping out, dropping/failing courses) (Dechter, 2009; Knight, 2004).

Though student characteristics may have a greater impact on graduation efficiency, which is not to say that institutions do not have a role in student's efficiency. "The reason why some students take more than four years [to graduate] may have as much to do with the institution as with the student" (Astin, 1997, p. 652). Institution characteristics, such as tuition and fees, student to faculty ratios, institution type, accreditation, location, and mission can influence retention and graduation (Goenner & Snaith, 2004). Factors under the institution's control such as availability of financial aid, the complexity of degree requirements, academic advising, and the articulation of transfer courses may slow a student's progress toward degree completion. Moreover, there is little to no research on the impact of the curriculum structure in a program of study.

This study will explore several student and institutional characteristics that may affect graduation efficiency. Specifically, how students transfer, curriculum structure, and program of study selection affect graduation efficiency. In addition, an evaluation of student demographics will also be conducted. A problem-structuring framework will be used to produce information on the problem. There is a review of the extensive research on student characteristics and degree attainment and transfer policy. However, there is little research on the curriculum structure and program of study selection. This study is

designed to expand knowledge in these areas.

Student demographics and precollege academic characteristics

Student demographic variables are characteristics a student brings with them to the higher education environment. These variables are beyond the student's ability to control, which include gender, age, and race/ethnicity. Outcomes related to graduating or not, time-to-degree, and rank-in-class have been shown to correlate with race/ethnicity, socioeconomic status (SES), and gender (Bowen et al., 2009). Furthermore, parental characteristics can influence a student's persistence, such as parent income, the level of education, and the support they provide their student (Astin, 1993, 1997; Bean, 1982; Blose, 1999; Pascarella, 1985; Poch & Wolverton, 2005). What follows is a review of literature on variables that may affect degree attainment efficiency.

Gender and race/ethnicity. Females perform consistently better than males in college. White students do consistently better than Black students (Astin, 2005; Bowen et al., 2009; DesJardins, Ahlburg, & McCall, 2002; Jones-White et al., 2010; Kena et al., 2015; Knight, 2004; Lam, 1999). Women graduate in less time than men do. The 6 year bachelor's degree graduation rate for first-time, full-time undergraduate students at a four-year degree granting institution in the fall of 2007 was 59 %. The graduation rate (within 6 years) for first-time, full-time bachelor's degree recipients of female students who began their education in 2007 was 62%, whereas, men for the same measurement was only 56 % (Kena et al., 2015).

Gillmore and Hoffman (1997) found that women, on average, out preformed men on the graduation efficiency index by 2.4 points. However, for women who pursued a BS degree had a slightly lower GEI (80.1) than men (81.2). Overall, most studies of gender

and time to degree suggest that women outperform men.

White students and Asians graduate in less time than non-White students (Bowen et al., 2009; Knight & Arnold, 2000). Bowen, Chingos, and McPherson (2009) found at flagship institutions and state selective institutions that only 61% of Black male students graduated in 6 years, 7% in the top half of the class, whereas, 39% of Black male students did not graduate. Female Black students fare a little better than their male counterparts, however, not by much. Seventy-five percent of Black female students graduate in 6 years, with 16% graduating in the top half of their class, whereas 25% of Black female students did not graduate. Hispanic students do better than Black students do but do not have the same outcomes as white and Asian students. Seventy percent of male Hispanic students graduate in 6 years, with 13% in the top half of their class, whereas 30% of Hispanic male students did not graduate. The Hispanic female student performed better than the male student. Eighty percent of female, Hispanic students graduated in 6 years, with 24% in the top half of their class, whereas, 20% of Hispanic female students did not graduate.

Asians outperform all other classifications, including Whites. Eighty-two percent of male Asians graduate in 6 years, with 25% in the top half of the class, whereas, 18% did not graduate. Asian females performed the best of all classification, except White females. Eighty-seven percent of female, Asian students graduated in 6 years, with an astounding 35% graduating in the top half of the class, only 12% did not graduate. Seventy-nine percent of White males graduated in 6 years, with 25% graduating the top half of the class, 21% of White males did not graduate. White females performed better than white males than any other classification. White females were slightly lower in the six-year graduation rate (85%) versus Asian females. However, White female graduated

40% in the top half of the class. Only 15% of White females did not graduate.

Socioeconomic status. The findings of Bowen, Chingos and McPherson (2009) also indicate that students from high-SES backgrounds are almost twice as likely to graduate in the top half of their class as students from low-SES backgrounds (36% versus 20%). Moreover, students from high-SES backgrounds are half as likely not to graduate from college as students from low-SES backgrounds (14% vs. 29%). Students from middle-SES backgrounds fall between high-SES and low-SES, with 26% of students graduating in the top half their class and 23% not graduating at all. These SES gaps are likely to continue and may increase as college cost increase, need-based aid decreases, and high-SES students remain better prepared academically than their low-SES counterparts (Doyle, 2010; Ellwood, Kane, & colleagues, 2000).

Age. Older students take longer to graduate than younger students (DesJardins et al., 2003; Gillmore & Hoffman, 1997; Knight & Arnold, 2000). Some graduates are older because they have taken longer to graduate, whereas some students enroll in college later in life. Delayed enrollment increases the probability that a student will drop out of college and decrease their likelihood of graduating (DesJardins, McCall, et al., 2002; Gillmore & Hoffman, 1997; Pascarella et al., 2005).

Dual enrollment programs. Dual enrollment programs are programs where participants are enrolled in both high school and college. Programs such as these are also known as “college transition programs” (U.S. Department of Education, 2003). Dual enrollment programs include “dual credit” and “concurrent enrollment,” and are known as “credit-based transition programs,” this category also includes International Baccalaureate (IB), Advanced Placement (AP), and early college programs (T. Bailey &

Karp, 2003).

Dual enrollment provides students with an inexpensive way for them to earn college credit while in high school. All 50 states have some type of dual enrollment program, and 40 states have a state-level policy that address dual enrollment (Allen, 2010; Karp, Bailey, Hughes, & Fermin, 2005). Some state programs offer free (e.g. Florida) or discounted (e.g., Texas and Utah) tuition and fees for students in these dual enrollment programs (Hoffman, Vargas, & Santos, 2008).

Researchers suggest that dual enrollees are more likely to persist in college and attain a college degree than nondual enrollees (An, 2013; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Morrison, 2008; Swanson, 2008; Taylor, 2015). However, the research is silent as to whether students who participate in dual enrollment programs are more efficient in terms of credit hour usage. Nevertheless, the research does show that dual enrollees are less likely to participate in math remediation than nondual enrollees (Kim & Bragg, 2008). Furthermore, studies tend to support that dual enrollment improves student academic preparation for college as a means to prepare students for the rigors of college course work (Allen, 2010; An & Taylor, 2015; Hoffman et al., 2008).

Student academic performance. Grades may well be the single best predictor of student persistence and degree completion. Furthermore, high school grades have been found to positively influence academic performance in college, as measured by GPA (Seidman, 2005). The concept of grades is common in education, the method of the calculation and standards applied can vary immensely between institutions and academic departments, which challenges the meaning of a grade and the GPA (Pascarella et al., 2005). Nonetheless, the attention given to grade performance in the research literature is

justified. Grades are one of the most consistent predictors of outcomes on large national studies and numerous single studies.

Findings suggest that students with lower high school GPAs take longer to earn their degree (Astin, 2005; Hall, Smith, & Chia, 2008; Knight, 2004; Knight & Arnold, 2000). Likewise, Astin (1993, 2005) suggests that a student's high school GPA is the strongest predictor of college graduation. The research of DesJardins, Ahlburg, and McCall (2002) puts forth that high school GPA has an effect on college GPA. However, their research found, when controlling for college GPA, that the high school GPA was not necessarily linked to graduation. Furthermore, when controlling for college GPA, the strength of precollege academic characteristics measures considerably declines (DesJardins, Ahlburg, et al., 2002). Gillmore and Hoffman (1997), further indicate that there is not a strong correlation between high school GPA and a student's GEI.

Transfer and academic characteristics

Student transfer and academic characteristics are variables that have been well studied. For the purposes of this study, focus is placed on degree attainment and efficiency in regards to student transfer, associate's degree attainment, major changes, academic standing, and remediation.

Student transfer. It is prevalent in higher education that many students transfer from one institution to another. In fact, it has been estimated that nearly 60% of all undergraduates have attended more than one institution (Cohen & Ibrahim, 2008; Snyder & Dillow, 2012). Policies, programs, and agreements have been made between departments, institutions, state systems, and regional state organizations to resolve issues associated with transferring institutions. The intention of these resolutions, is to increase

transferability and reduce credit loss, which in turn increases graduation efficiency for students who transfer.

Student transfer and policies. The community college mission facilitates the pathway to baccalaureate degree attainment by providing freshman- and sophomore-level coursework and aiding transfer to four-year institutions (Brint & Karabel, 1989). By 2004, 30 states had some form of legislation regarding the movement of students between higher education institutions. State involvement in articulation between public institutions has been accompanied by an increase of reports and analyses of articulation policies and practices (Bender, 1990; Dougherty, Reid, & Nienhusser, 2006; Hungar & Lieberman, 2001; Knoell, 1990; Wellman, 2002). These reports provide valuable information about practices regarding articulation and transfer practices. Some of the reports focus on the state efforts to facilitate equality of educational opportunity while other reports focus explicitly on examining articulation policies.

Transfer articulation refers to an academic evaluation of course work transferred to a receiving institution from another institution to determine if there are comparable courses. If the courses are similar to the receiving institution's course content, then the courses are often determined to be equivalent courses. If the course content does not match then the course is transferred in as a general elective. These courses will count as overall credit towards the degree but more than likely do not meet major or minor requirements. More in-depth course equivalency assessments are based on an evaluation of the course syllabus. However, course syllabi are difficult to obtain. Therefore, the majority of course equivalencies are based on course descriptions provided in the institution catalog (Knoell, 1990; Sullivan, Dyer, & Franklin, 2004).

To define how courses will be accepted from a college or university to another college or university, states and institutions have instituted transfer articulation policies. State transfer articulation policies, like policies instituted in Utah, require public institutions to: (a) accept all freshmen level courses and above for a minimum of general elective credit; (b) require colleges and universities in the state to implement common course numbering; or (c) an overall acceptance of general education courses at all state colleges and universities (Utah System of Higher Education, 2016).

Many states use articulation policies as the mechanisms with which to influence the transfer process. Articulation is the agreement among faculty that course content and learning outcomes are the same or similar at both the sending and receiving institutions. Articulation is the apex of student transition between institutions and matters to the majority of students who transfer and desire to earn a bachelor's degree (Adelman, 2006; Anderson, Sun, & Alfonso, 2006; Dougherty & Kienzl, 2006; Roksa & Keith, 2008). Therefore, an effective transfer policy for all students should increase efficiency, decrease credit loss, and improve transfer rates.

Articulation policies and efficiency. Efficiency in the transfer process can be an indefinite term. The simple definition of efficiency is the relationship between inputs and outputs (Coelli et al., 2005). Nevertheless, there are varying definitions for inputs and outputs. Therefore, efficiency in the transfer process can be measured as the number of community college students enrolled in the input and total of community college students who successfully transferred to a baccalaureate granting college or university as the output; this measurement defines the transfer rate. However, efficiency can also be measured based on credit accumulation at the graduation of a baccalaureate degree for

transfer students. If students graduate with excessive credit, credit that is beyond the minimum required for the degree that did not meet degree requirements, because courses from their previous institution did not transfer or did not articulate, then this is defined as loss of credit, creating inefficiency.

States try to facilitate transfer between institutions by implementing articulation policies, to increase these measures of efficiency. Many of the policies include common course numbering, transferability of general education courses, or formal agreement of transferability of courses between institutions. The policies do not necessarily encourage students to transfer but rather ease the process for students who have already decided to transfer and prevent loss of credit (Roksa & Keith, 2008).

The states' focus on efficiency is to reduce credit loss, not to increase student transfer rates (Roksa, 2009; Roksa & Keith, 2008). The pathway to the baccalaureate degree is through efficient transfer rates. The gap between the community college and four-year institutions is a vast chasm where many students are unable to make the leap to the four-year institution. State policies have not done enough to bridge the gap. An inefficient transfer system can be detrimental to all students (Anderson et al., 2006; Dougherty & Kienzl, 2006; Hungar & Lieberman, 2001; Wellman, 2002).

Articulation policies and transfer rates. States presumably implement transfer policies to increase the transfer rate between community colleges and four-year institutions. There must be a consensus among researchers, policymakers, and institutions on transfer student criteria to assess the transfer rate. Transfer refers to the flow of students between institutions and programs. However, there are concerns regarding a lack of a precise definition of transfer. Thus, the inability to compare transfer rates across

studies, institutions, or states, saturate the transfer literature (Barkley, 1993; Clagett & Huntington, 1992; Cohen, 1994; Laanan & Sanchez, 1996; Palmer & Eaton, 1991; Spicer & Armstrong, 1996). Therefore, at the heart of the definition of transfer is the question of whom to include in the calculation of a transfer rate. Students who have completed a course at another institution? Students who completed at least 30 credit hours and transferred to a new institution? Students who complete an associate degree? Students who only transfer from a community college? Alternatively, some other definition?

The lack of a precise definition for the transfer rate is problematic in developing a policy proposal. There has been a substantial amount of research examining the effects of articulation policies on transfer rates. Nevertheless, varying definitions make it difficult to parse out the effect of articulation agreements. The most persuasive assessment of the effectiveness of articulation policies would result from utilizing state longitudinal data on the transfer before and after policy implementation (Roksa, 2009; Roksa & Keith, 2008). However, states often lack longitudinal data that predate the implementation of the articulation policies. Thus, it is difficult to assess a causal relationship through the data available.

Anderson, Sun, and Alfonso (2006) used a nationally representative sample from the Beginning Postsecondary Students (1989-1994) data to estimate the likelihood of transfer from a community college to a four-year institution. Surprisingly, they found no effect of articulation policies on transfer rates. In support of this finding, Roksa and Keith (2008) examined students' likelihood of transfer using National Education Longitudinal Study (1988-2000) and also found no effect of state articulation policies on transfer rates. However, Banks (1994) found that institutions with formalized statewide articulation

policies have significantly higher transfer rates. Banks' findings were based on a dataset of 78 institutions in 15 states and controlled for various characteristics. Higgins and Katsinas (1999) found evidence to support Banks'(1994) initial findings. However, Higgins and Katsinas (1999) findings are challenged because that the majority of the sample was dominated by two states: a) California, which did not have a formalized articulation policy, and b) Texas that did have such a policy.

The studies contradict each other on their findings, rendering inference about the effectiveness of state policies inconclusive. Given the evidence and the limitations of the studies, it is not appropriate to infer that articulation policies increase transfer rates. Then what are articulation policies intended to do if the policy does not increase transfer rates? A body of literature has examined the relationship between articulation policies and credit loss.

Articulation policies and credit loss. Roksa and Keith (2008) performed a detailed review of the state statutes and indicated that statewide articulation policies are not necessarily designed to facilitate the transfer. Instead, the language suggests that articulation policies are designed to preserve credits as students transition from one institution to another. Deduced from the language of the policies is the intention to assist students who have already decided to transfer rather than encourage students to transfer. Hence, articulation policies are better studied after students transfer rather than whether the policy increases the transfer rate.

If policies are designed to prevent credit loss during the transfer process, then we can assume that a good indicator to measure the success of an articulation policy is the number of credits a student keeps in the transfer process. However, the acceptance of

transfer credit does not mean the credit applies to the degree requirements. Logically, the more credits a student keeps during the transfer process and applies to the degree requirements, the less time it will take to complete the degree.

Roksa and Keith (2008) evaluated state articulation policies based on transfer outcome rather than transfer rate. Their findings include three related outcomes: (a) number credits transferred, (b) time to a bachelor's degree, and (c) completion of a bachelor's degree. They found that students who transfer in states with established articulation policies fared no better than students who transferred in states with no articulation policy. Moreover, they found no statistical evidence that articulation policies influence number of credits transferred, time to a bachelor's degree, or completion of a bachelor's degree (Roksa & Keith, 2008).

All state governing bodies have at least a statement and many have complex policies regarding transfer of students between institutions (Dougherty et al., 2006; Roksa, 2009; Roksa & Keith, 2008). There are four major areas on which state transfer articulation policies focus: state articulation agreements, state-level transfer articulation bodies, transfer student services, and performance and data feedback systems (Bender, 1990). Not all states have implemented all the key areas into policy, and the policy rarely affects private institutions.

Associate's degree attainment. There has been growing interest in determining whether earning an associate's degree pretransfer is important or not (Crook, Chellman, & Holod, 2012; Crosta & Kopko, 2014). Descriptive research suggests that community college transfer students who earn an associate's degree demonstrate higher rates of bachelor's degree attainment as compared to students who did not transfer with an

associate's degree (Doug Shapiro et al., 2013). However, it is unclear if earning the associate's degree has causal relationship to bachelor's degree attainment. Nevertheless, Crook and colleagues (2012) found that students who earned an Associate of Science or an Associate of Arts degree had marginally higher probabilities of bachelor's degree attainment, but found no effect for the Associate of Applied Science degree.

The effects of earning an associate's degree are limited. The current research has shown earning an associate's degree pretransfer may have a positive effect on bachelor's degree attainment (Belfield, 2013; Crook et al., 2012; Crosta & Kopko, 2014), but these studies are limited to earning a transfer associate's degree and do not address the efficiency of degree completion.

Major changes. Logic would suggest that the more a student changes their major the less likely the student is to graduate. However, findings (Micceri, 2001; Murphy, 2000; Venit, 2016) repudiate this idea and suggest that switching majors has little impact on graduation rates. Murphy (2000) found that each major change increased a student's graduation probability by 40%. The act of switching majors is less about indecision but more about a commitment to earn a degree. Furthermore, students who switch majors do not extend their time to degree completion (Venit, 2016). However, the research did not indicate if switching degrees increased or decreased the efficient use of credit hours towards graduation. Venit (2016) speculated, students switching majors may be changing to adjacent majors with overlapping course requirements or, that switching majors may not generate unproductive credits that extend time to degree. However, it was not examined in his study.

Academic achievement. A student's success or failure in the classroom is a

strong predictor of the length of time to degree completion (Adelman, 2006; Jones-White et al., 2010; Knight, 2004; Knight & Arnold, 2000). Inductive reasoning would suggest that the more a student fails, repeats or withdraws from courses, the more likely the behavior will increase the number of semesters a student must enroll to complete a degree because those academic transactions do not increase credit that can be applied to a degree. Past research has found that a student who withdraws or fails 10-20% of their course work is less likely to complete a bachelor's degree compared to students who do not withdraw or fail (Cabrera, Burkum, & La Nasa, 2005).

Remediation. Students participating in remedial course work are ubiquitous in higher education (Radford & Horn, 2012). Remediation is designed to strengthen academic skills, specifically among students with limited academic preparation (Attewell, Lavin, Domina, & Levey, 2006; Bettinger & Long, 2009; Parsad & Lewis, 2003). A significant number of high school students – about two-thirds – are not college ready and need remediation (Greene & Winters, 2005). College and universities address this problem with remedial programs designed to help students develop the necessary skills, typically in math and English, to overcome the lack of academic preparedness (Parsad & Lewis, 2003).

Proponents for remediation programs suggest that remedial courses and services provide educational opportunities for underprepared students, whereas, opponents contend that remediation is costly and secondary school should better prepare students for the rigor of the college-level courses (Bahr, 2008). Furthermore, critics have argued that remediation may prolong time to degree completion due to the increased requirements a student needs to fulfill before taking college-level courses (Bettinger & Long, 2009).

The research findings on remedial programs have been mixed. Some studies suggest that remediation improved students' chances of completing college-level courses, college persistence, and degree attainment (Attewell et al., 2006; Bahr, 2008; Bettinger & Long, 2009; Lesik, 2006) while other studies did not find significant impacts of remediation on retention, transfer, and degree completion (Calcagno & Long, 2008; Martorell & McFarlin Jr, 2011; Scott-Clayton & Rodriguez, 2014). Nevertheless, the research community lacks sufficient evidence on the effect of remediation and degree completion efficiency.

Curriculum structure

The program of study choices (major, minor, degree) along with how the curriculum is structured may impact how efficiently a student completes their degree. The research on curriculum structure is very limited. Nevertheless, Gillmore and Hoffman (1997) found that the type of degree (BS or BA) a student pursued impacted graduation efficiency. Students who graduated with a BA had a higher efficiency index than students who graduated with a BS degree. The variance between the two types of degrees may be due to how the curriculum is structured, such as the number of credits required for general education, major requirements, minor requirements and the number of free electives available in the program of study. Theoretically, programs of study that have more free electives built into the curriculum may be more forgiving for students with excess credits, which do not meet general education, major, or minor requirements. Nevertheless, more research is needed to understand how curriculum structure affects graduation efficiency.

Conceptual Framework

The framework guiding this study conceptualizes policy analysis as a multidisciplinary inquiry aimed at the creation, critical assessment, and communication of policy-relevant information. Policy analysis is a problem-solving discipline. The analysis draws on social science methods and theories to solve practical problems (Dunn, 2012).

The methodology of policy analysis is a process of "reasoned inquiry aimed at finding solutions to practical problems" (Dunn, 2012, p. 3). Policy analysis is methodologically heterogeneous; it is not confined to a specialized social science field or constrained by the doctrines and principles of philosophies of science. Rather, as long as the research yields reliable knowledge, policy analysis may draw from a wide range of scientific methods, both qualitative and quantitative. Because there is a wide range of methods, the separation between science and nonscience methods should not be problematic. Nonetheless, the focus should be placed on the distinction between reliable and unreliable knowledge (Cohen & Laudan, 2012).

Policy analysis is partly descriptive and partly normative. Traditional social science disciplines are descriptive, which means they describe and explain the causes and consequences of policy, whereas normative refers to a value judgment about what ought to be, in contrast to descriptive statements about what is (Dunn, 2012; Friedman, 1953). Policy analysis draws on normative orientation to investigate problems of efficiency. This method of inquiry demands that we choose among desired consequences and a preferred course of action. Efficiency analysis requires a value judgment of what is the threshold of efficiency and what increases efficiency or decreases efficiency. Nevertheless,

descriptive methods are used to explain what contributes to efficiency and inefficiency. The analyst then draws on normative methods to ascribe an efficiency threshold. This study uses descriptive methods to identify variables that may cause a decrease of the GEI. However, it is up to analyst and administrators to use normative methods to determine thresholds.

It is important to develop policy-relevant information to investigate policy-related questions. According to Dunn (2012), there are five types of policy-relevant information, which are policy-informational components: policy problems, expected policy outcomes, preferred policies, observed policy outcomes, and policy performance.

Dunn (2012) indicates that policy analysis is designed to provide policy-relevant information about five types of questions. The answers to these questions yield five types of information, which are informational policy components (see Table 1 at the end of the chapter).

The five types of policy-relevant information are interdependent. The creation of information at any point depends on data produced in an adjacent phase (Dunn, 2012). However, information about a policy problem is critical throughout the other phases. In statistical hypothesis testing, there are two types of errors a researcher must be aware of: type I error, a rejection of true null hypotheses (a false positive) and type II error, a failure to reject a false null hypothesis (a false positive) (Field, 2009; Gall et al., 1996). As it relates to the formulation of a policy problem there is potential for a type III error – defining the wrong problem (Kimball, 1957; Mitroff, 1976; Raiffa, 2015).

Policy analytic methods are used to evaluate policy-relevant information, and involve judgments to accept or reject an explanation, a prediction, a prescription, a

rightness of action, or the formulation of a problem. Dunn (2012) suggests there are five types of policy analytic methods (see Figure 1). (1) Problem Structuring is a method to produce information about which problem to solve. (2) Forecasting is a method used to generate information about expected outcomes. (3) Prescription is a method used to create information about preferred policies. (4) Monitoring is a method used to create information about observed policy outcomes. (5) Evaluation, the method used to produce information about the value or utility of observed policy outcomes and their contributions to policy performance.

It is important to note that problem structuring is, as Dunn (2012) described, a metamethod (method of methods). Problem situations are not problems; problems are a representation of problem situations. A problem situation may be that transfer students are accumulating more credits than needed for a bachelor's degree at graduation. This scenario is a problem situation, not a problem because another analyst may state that the degree structure causes students to graduate with more credit than needed. Both analysts are describing a policy problem with is the accumulation of more credits than needed at graduation, but are crediting different problem situations as the cause of the problem. A policy problem is defined by the different assumptions the policy stakeholders ascribe to the problem situation. Therefore, a policy problem may have different formulations that utilize information generated from the problem situations. Problem structuring is a procedure for testing different representations of a problem situation; this is the central guidance system of policy analysis (Dunn, 2012).

For this study, the focus will be on problem structuring and problem finding methods. Anderson (2010) defines a problem "as a condition or situation that produces

needs or dissatisfaction among people and for which relief redress by administrative action is sought" (p. 85). Therefore, the problem ascribed in this study is a need or dissatisfaction of students' degree efficiency. Problem structuring is the method to generate information about which problem to solve (Dunn, 2012). Problem finding is a strategy of analysis, which is retrospective in nature. Problem-oriented analysis seeks to identify variables that may explain the problem. This method aligns with normative decision theory, which is a set of logically consistent propositions that evaluate or prescribe action (Bower, 1968). Problem structuring begins with problem sensing (see Figure 2). A researcher or administrator senses that there is a problem, but the problem has yet to be studied. Problem sensing then moves to problem search, which identifies problem situations. As stated previously, problem situations are situations that contribute to the overall problem. Problem situations are studied to understand and structure the problem. If the researcher or administrator is confident that they have the right problem situations, they move to defining the policy problem. The administrator then determines if they have the right problem. If yes, then the administrator moves to problem solving and developing a solution. Finally, the solution is implemented and tested for efficacy.

The purpose of this study is to use problem-structuring methods to produce information about what problem situations influence degree efficiency. The problem-sensing step determined that there might be a problem with students graduating with more credit than needed to complete a degree. Several problem situations have been identified that need to be further studied to develop policy relevant information to properly structure the problem. The problem situations are: (a) demographic and precollege academic characteristics; (b) transfer and academic characteristics; and (c)

curriculum structure. These problem situations are studied to produce information on to what extent the situation contributes to degree efficiency. Administrators, from the information produced from this study, can then structure the policy problem and develop a solution to the problem.

Table 1

Five types of policy-relevant information (Dunn, 2012).

	Question	Information
Policy problem	What is the problem?	The policy problem is an unrealized need, value, or opportunity for improvement attainable through public action.
Expected policy outcome	What are the expected outcomes of the policies designed to do?	These are likely consequences of one or more policy alternatives designed to solve a problem.
Preferred policies	Which policies should be chosen, considering not only their expected outcomes but also the value of the costs and benefits?	The preferred policy is a potential solution to a problem.
Observed policy outcomes	What policy outcomes are observed, as distinguished from the outcomes expected before a preferred policy in implemented?	The observed policy outcome is the past or present consequence of implementing a preferred policy.
Policy performance	To what extent do observe policy outcomes contribute to the end results?	The policy performance is the degree to which an observed policy outcome contributes to the solution of a problem.

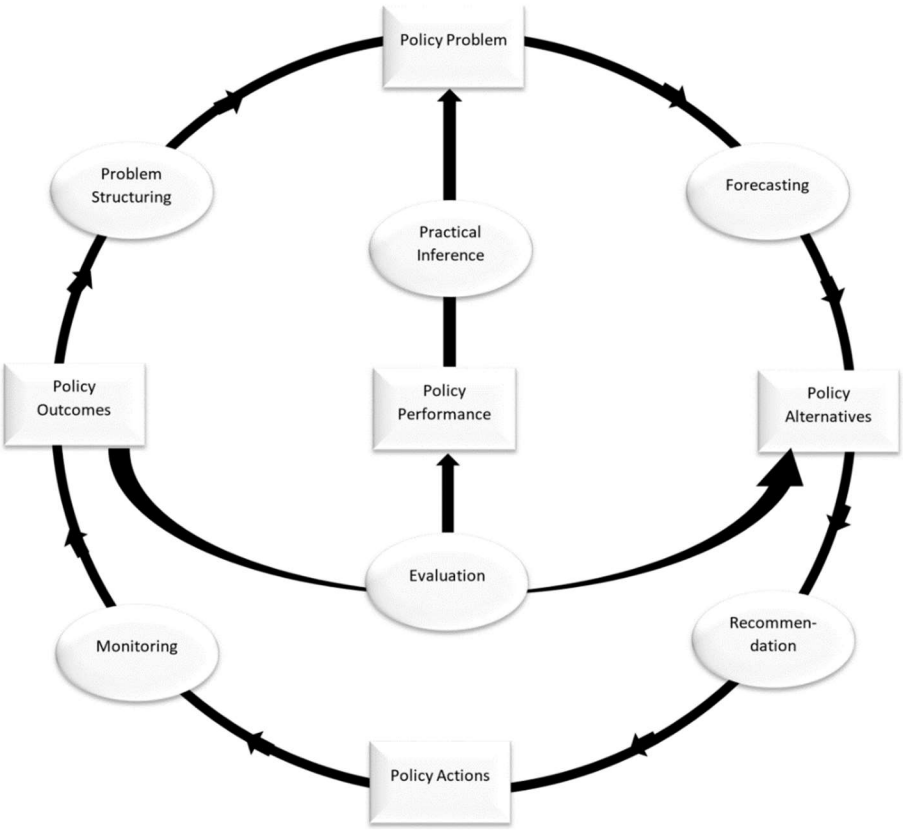

Figure 1. Policy analytic methods used to evaluate policy-relevant information (Dunn, 2012 p. 6)

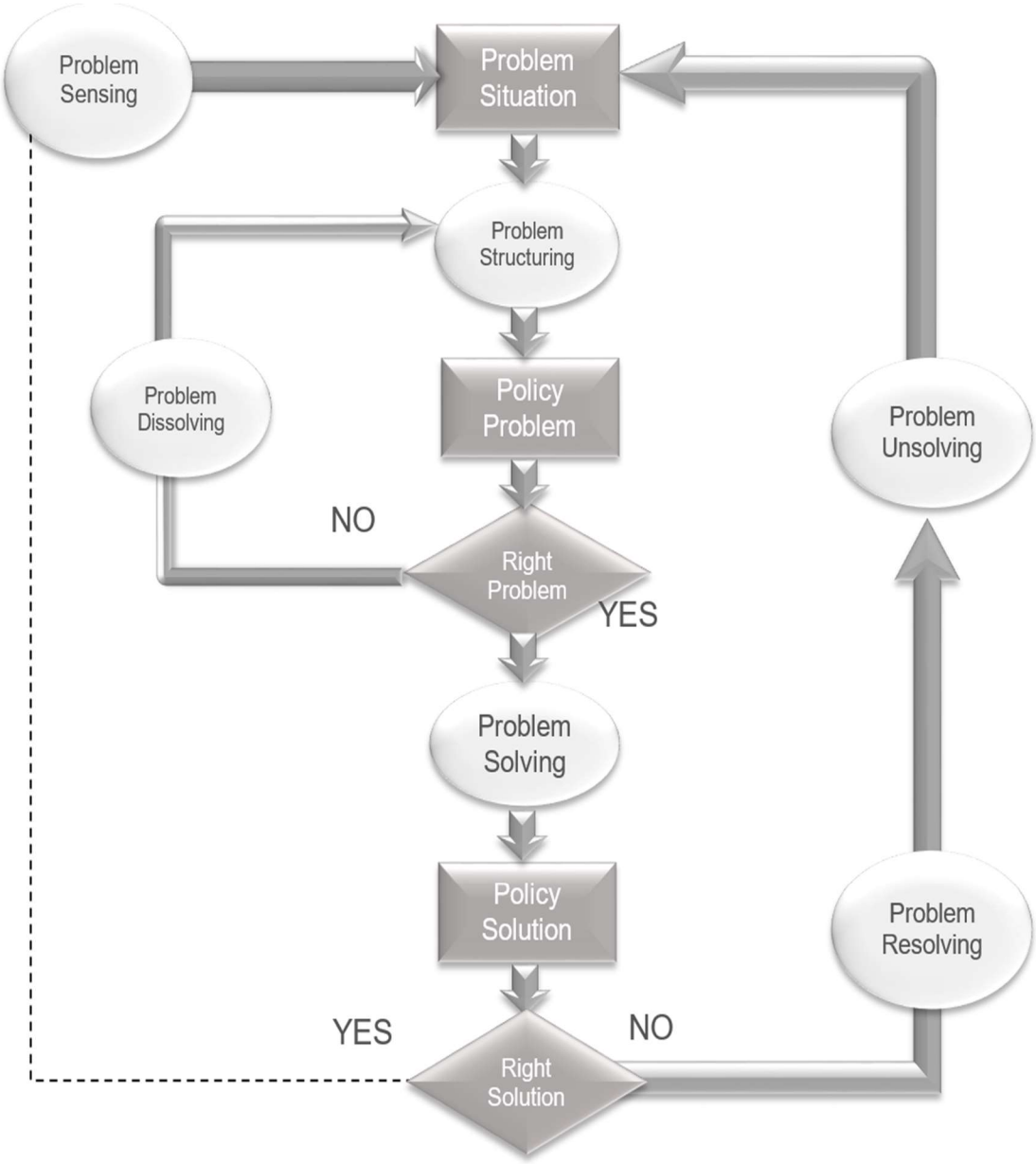

Figure 2. Problem structuring decision flow chart (Dunn, 2012 p. 68)

CHAPTER III

RESEARCH DESIGN

The previous chapter reviewed the literature on graduation efficiency measures and variables that may affect graduation efficiency. There is a need for more empirical research to identify problems along the degree pathway that influence graduation efficiency. This study seeks to contribute to this gap in the literature in the context of evaluating variables that affect the Graduation Efficiency Index of students at Weber State University.

Research Questions

The questions guiding this study are to produce information about each problem situation. Problem structuring is the method to generate information about which problem to solve. The design of this study is to identify variables that may explain problems related to graduation inefficiency.

Through policy analysis, this study sought to examine the following research questions:

1. What is the bivariate correlation among the GEI and:
    (a) demographic and pre-college academic characteristics (i.e., gender, age at graduation, race/ethnicity, dual enrollment programs, entry GPA, and Pell grant eligibility),

(b) student transfer and academic characteristics (i.e., transfer students, number transfer institutions, the number of major changes, transfer associate degree, WSU associate degree, failed a course, withdrew from a course, remedial course, repeated a course and GPA at graduation) and;

(c) curriculum structure (percentage of free electives in the program of study)?

2. Do demographic and precollege academic characteristics predict degree efficiency?
3. Controlling for demographic and precollege academic characteristics, do transfer and academic characteristics predict the GEI?
4. Controlling for demographic, precollege academic characteristics, transfer and academic characteristics, does the curriculum structured predict the GEI?

Problem Structuring

What follows is a conceptual and theoretical review of the literature on using problem-structuring methodology. “Policy problems are unrealized needs, values, or opportunities for improvement. Information about nature, scope, and severity of a problem is produced by applying the policy-analytic procedure of problem structuring” (Dunn, 2012, p. 67). A fundamental goal of problem structuring is to identify the correct problem. The process of problem structuring is multidisciplinary and essential to the methodology of policy analysis. Each phase of problem structuring requires different kinds of methodological skill sets. For identifying formal problems mathematical and statistical analysis, econometrics or regression modeling is suggested (Dunn, 2012).

Multiple regression analysis is the problem structuring methodology employed in

this study to identify problems in graduation efficiency. Multiple regression analysis is a set of techniques used to assess the relationship between a dependent variable (DV) and several independent variables (IV). Multiple regression is used when the intent of the analysis is a prediction, whereas correlation is used when the purpose of the study is to assess the bivariate relationship between the DV and an IV (Tabachnick, Fidell, & Osterlind, 2001). The purpose of this study is to predict graduation efficiency from multiple variables to identify which variables significantly contribute to efficiency. The significant variables are considered problem situations, which are used to structure policy problems.

The results will indicate what influence each variable has on the GEI. Variables that are statically significant will produce information about the problem. For instance, how much changing majors affects graduation efficiency or should students earn an associate's degree before transferring. Administrators, researchers, and practitioners can then identify potential solutions to the problem. Problem structuring only provides information about the problem, not necessarily the solution to the problem. The scope of this research is the first step, identifying and providing information about the problem. Following this research, the steps suggested in policy analysis, for future research, are to design policy to mitigate the problem, implement the solution, and finally, evaluate if the policy was effective (Dunn, 2012).

Data and Instrumentation

The study draws on the previously described theory to predict the GEI of students who have completed a bachelor's degree. The remainder of this chapter describes the research design including the dataset, sample and a description of the dependent and

independent variables. Then I describe my analytical approach using correlation and multiple regression and the GEI.

Dataset

This study used data obtained from WSU. WSU is a public institution in Ogden, Utah, and one of eight institutions in the Utah System of Higher Education (USHE). The dataset is from the institution's data warehouse and student information system. The dataset was transferred as an encrypted comma-separated value (CSV) file, following approval from the Associate Provost of Enrollment.

Institutional Setting

This study was conducted at Weber State University located in Ogden, Utah. Ogden is a community of about 83,000 residents and is 40 miles north of Salt Lake City. The surrounding areas that WSU serve include Davis, Weber, and Box Elder counties with a total population of approximately 589,000 residents. WSU is a large public four-year open enrollment institution with a head count of more than 26,000 full time and part time students. WSU offers more than 250 undergraduate programs of study. Additionally, the University offers 14 master's programs (WSU Fast Facts, 2015). The Carnegie Institutional Classification considers WSU as a commuter campus with a very high undergraduate population, with a larger portion of the student body attending part-time. (Carnegie Classification, 2015).

To better understand the demographics of the research sample, some information about the undergraduate student body as a whole is presented here. The total undergraduate enrollment as of October 14, 2014, was 25,335. Total degree-seeking

students are 17,795. Much of the nondegree seeking population is a result of a significant number of concurrent enrollment students, high school students enrolled in college credit courses. More women (53.3%) than men (46.7%) are degree-seeking students. Only 61.2% of the population is enrolled full-time, whereas 38.8% are enrolled part-time. More women enroll part-time than men; 40.4% of women are enrolled part-time as compared to 36.9% of men are enrolled part-time (WSU Institutional Research, 2015).

Table 2 at the end of the chapter outlines the population according to race and ethnicity. The majority of students who attend WSU are White. Nevertheless, there is a large group of students who have chosen not to self-identify. The next largest population is Hispanic/Latino (WSU Institutional Research, 2015).

The number of bachelors' degrees awarded between July 1, 2013 and June 30, 2014, was 2,349. Also, in addition to the number of bachelor's degrees awarded, WSU also awarded 1,994 associate's degrees, 272 master's degrees, and 75 certificates (WSU Institutional Research, 2015).

Sample

The sample is derived from a dataset on WSU graduates. The sample consists of students who graduated with a bachelor's degree (BS, BA, BFA, BM, and BME) during the 2013-2014 and 2014-2015 academic years. The total sample was 3,843 graduates. It is important to understand some decisions about the sample construction. The sample includes students who began participation in higher education during or after the 2002-2003 academic year. This decision was made because students who enrolled at WSU before 2002 may have credits that were converted from quarters to semesters. The conversion of credit complicates the data, and thus has been excluded. Additionally,

students who pursued dual majors, dual degrees, or a second bachelor's degree were excluded from the sample. Students in these pathways appear to exceed the minimum requirements and have excessive credit by design. The purpose of this study is to evaluate problems for students who are pursuing one bachelor's degree (the majority of students), so understanding inefficiencies of students with multiple majors and degrees is beyond the scope of this study.

The sample comprises 1,326 (34.5%) transfer students. WSU, based on its current admission criteria, considers students who transferred with 30 or more credits from a regionally accredited institution as transfer students. Only participants who transferred with 30 or more credits were considered as transfer students for this study. Students who transferred with fewer than 30 credits were considered WSU native students (n=2518).

The majority of the students in the sample were White (n=2,948, 76.7%). The next largest population was Hispanic with n=244 (6.3%) participants. The populations for African American (n=51), Asian (n=77), American Indian (n=16), Native Hawaiian or Pacific Islander (n=17), and students who identified two or more races (n=49) had a low number of students and lacked statistical power, and were therefore combined into one group called "Other" totaling n=210 (5.5%) students. Nonresidents totaled 143 people or 3.7% of the population. Unfortunately, there was a large number of students who were identified as Unknown (n=299, 7.8%). The data were evaluated both with these students included in the sample and with the students not included in the sample. The decision was made to include the "Unknown" race and ethnicity students in the sample because removing them did not affect the overall outcome.

Outcome and Predictor Variables

This study uses multiple regression to predict the GEI of students who have graduated from WSU from several variables known to influence graduation efficiency. Multiple regression is used to predict the value of the DV from several continuous or dichotomous IVs. The regression equation is as follows:

$$Y' = a + b_1X_1 + b_2X_2 + \cdots + b_kX_k \quad (3)$$

Where Y' is the predicted value of the DV, a is the Y-intercept, the Xs represents the various IVs, and the bs are the coefficients associated with each IVs during regression (Tabachnick et al., 2001).

Variables associated with degree efficiency were analyzed using data obtained from students who graduated with a bachelor's degree during the 2013-2014 and 2014-2015 academic years. The variables selected were based on the review of the literature. While many variables were studied, by no means is this an exhaustive list. The variables selected are intended to cover a broad and thoughtful investigation of problem situations.

Dependent variable

The dependent variable is the Graduation Efficiency Index (GEI). The GEI is a methodology that measures how efficiently students completed their degree. Gillmore and Hoffman (1997) at the University of Washington developed the method. The GEI is a percentage score based on total credit hours required for the degree and total cumulative attempted hours. The GEI can be used to evaluate different intensities of attendance, both students who attend full time and part time. The GEI can be averaged to compare various groups of students or degree programs. The calculation can be used as a dependent or correlative variable. Specifically, research can be conducted that examines native versus

transfer students, students across academic departments or students in different programs of study. Finally, the GEI can be tracked longitudinally to assess effects of policy change. For the purposes of this study, the GEI will be used as the dependent variable.

The equation for the GEI used for this study is as follows:

$$GEI = \frac{\text{Total Credits Required for the Degree}}{\text{Cumulative Attempted Hours}} \text{ X } 100 \quad (4)$$

The total credits required for the degree are a calculation of total required hours in general education, major and minor requirements, and free electives that total to a minimum of 120 credits. Some programs of study, however, total more than the minimum 120 credit hours. In such cases, the minimum would be the total calculation of all required general education, major, and minor hours. Transfer credits are earned credit that was completed at another institution and transferred to the degree granting institution. The student's total cumulative attempted hours including earned hours, failed, withdrawn, and remedial credit hours are the total hour attempted at WSU and other transfer institutions.

The minimum credits required for the degree are not a data element that is readily available in WSU's student information system. Therefore, this number was manually calculated based on the student's program of study. The items in the calculation consist of total hours required for general education (GE), total credit hours needed for the major (MJ), and total credits necessary for the minor (m) (if applicable). For the equation, to obtain the total Free Electives (FE), the total from GE+MJ+m is subtracted from 120, which is the minimum required for a bachelor's degree. In some programs of study, FE may result in a negative number. There cannot be negative requirements. Therefore, if the total FE was a negative number, then FE was converted to zero. FE was then added to the

total of GE+MJ+m to get the total credits required for the degree. The result was a number that was equal to or greater than 120.

$$GE + MJ + m = X \quad (5)$$

$$120 - X = FE$$

GE + MJ + m + FE = Credits Required for Degree

If there was a variable credit option within the elements, the higher number was used to calculate the degree credit hours. For example, if the requirement was a range from 37 to 41 credits the higher number was utilized.

The total credits for general education can vary depending on the courses a student took, a student's academic preparation, and the ability to test out of some requirements, such as computer information literacy. For this study, the total general education calculation was standardized to 41 credit hours. This calculation assumed that the student was academically prepared but did not test out of required courses. This calculation also was the most common path that students at WSU pursue.

To further illustrate the calculation of total credits for a program of study, the calculation for a student who has graduated in a Sociology major with Gender Studies minor may calculate as follows. Where 41 credit hours are required for GE and 36 credit hours for the MJ in Sociology and 18 credit hours for the m in Gender Studies.

$$41 + 36 + 18 = 95 \quad (6)$$

$$120 – 95 = 25$$

$$41 + 36 + 18 + 25 = 120$$

The GE, MJ, and m sum to 95 credits, this number indicates the total number of required credits for the program of study. For the student to graduate the student must complete a

minimum of 120 credit hours. Therefore, 95 was subtracted from 120 to sum 25, this number represented the number a FE the student must take to earn a degree. FE credit may be completed from any discipline.

Another example of a student who graduated in a Business Management major with a Spanish minor. Where 41 credit hours are required for GE and 74 credit hours for the MJ in Business Management and 15 credit hours for the m in Spanish.

$$41 + 74 + 15 = 130 \quad (7)$$

$$120 – 130 = -10$$

$$41 + 74 + 15 + 0 = 130$$

For the business student, in this example, the total FE equaled -10, therefore the negative number was converted to zero in the final calculation. The total credit hours required for the program of study equals 130, which will be the number used for GEI equation.

Attempted hours was a calculation of all course credit that was earned, failed, repeated, withdrawn, and remedial. Attempted hours was a standard calculation on the student transcript and was available in the student information system. Cumulative Attempted Hours, the total attempted hours of WSU courses and transfer courses are used for the GEI equation.

WSU was thorough and extensive in the transcription of transfer credit hours. Earned, failed, repeated, and remedial course work was transcribed in the student information system. However, transfer withdrawn courses are not recorded in the student information system. The transfer credits used in the equation consist of attempted transfer hours rather than total earned hours. Earned transfer credit hours are credits that have been accepted by WSU and may be applicable towards degree requirements. Attempted

transfer credit hours include all earned credit hours and repeated and remedial credit hours. Not all attempted hours may be used towards degree requirements. The attempted transfer credit hours calculate inefficiencies at the previous institution.

Independent variables

Several independent variables are included in the study that represent factors that influence degree efficiency. The variables are sorted into three groupings: demographic and precollege academic characteristics, transfer and academic characteristics, and curriculum structure. The grouping of variables was used for the hierarchical multiple regression analysis. The first grouping, demographic and precollege academic characteristics include: gender, age at the time of graduation, race and ethnicity, participation in dual enrollment programs (advance placement, international baccalaureate, concurrent enrollment and early college), entry GPA, and Pell grant eligibility. The second grouping, transfer and academic characteristics include: transfer students, the number of transfer institutions, the number of major changes, transfer associate degree, WSU associate degree, ever failed a course, ever withdrew from a course, ever repeated a course, if a student ever took a remedial course, and GPA at graduation. The final grouping, Curriculum Structure, includes the percentage of free electives in a program of study.

Demographics and precollege academic characteristics. Demographics and precollege academic characteristics are data that are gathered about students who are entering into the institution. The data available in the student information system related to demographic and precollege academic characteristics include gender, age at graduation, race/ethnicity, socioeconomic status represented by Pell grant eligibility,

participation dual enrollment programs (concurrent enrollment, early college, International Baccalaureate and Advance Placement) and entry GPA. These variables are known to influence retention and persistence in higher education (Adelman, 2006)

Gender. A dichotomous variable where male is 0 (n= 1821) and female is 1 (n=2022).

Age at graduation. A continuous variable based on what age the student was at the time the bachelor's degree was conferred. The mean age at graduations was 25 (SD=6.66) with a minimum of 17 to a maximum of 63.

Race/ethnicity. The majority of students who graduate from WSU are White (76.7%), the rest of the sample population is represented by Hispanic/Latino (6.5%), African American (1.3%), American Indian (0.4%), Asian (2%), Native Hawaiian, or Pacific Islander (0.4%), Two or More Races (1.3%), Nonresident (3.7%) and Unknown (7.7%). For the statistical analysis race/ethnicity was dummy coded into 4 variables with the White group (n=2,948) as the comparison group, Hispanic/Latino (n=244), Nonresident (n=143), Unknown (n=299) and Other (n=210). The Other category is a combination of African American, American Indian, Asian, and Native Hawaiian or Pacific Islander, and Two or More Races representing 5.5% of the sample population.

Federal Pell grant. This is a dichotomous variable based on whether the student was eligible for a Federal Pell Grant or not, which represents socioeconomic status. The eligibility of the Federal Pell Grant is determined based on when a student fills out a Free Application for Federal Student Aid (FAFSA). However, not all students fill out the FAFSA and those who did not may have been eligible for federal Pell grants. Nevertheless, 2,360 (61.4%) were eligible for the federal Pell grant.

Dual enrollment high school programs. There are several programs that students in high school can participate in that will award the student college credit by completing the course or passing a test. These programs include Advance Placement, International Baccalaureate, Concurrent Enrollment and Early College. The variable was coded as a dichotomous variable where 0 indicates the student did not participate in any dual enrollment program (n=2,520, 65.6%) and 1 indicates that a student participated in one or several dual enrollment programs (n=1,323, 34.4%).

Entry GPA. Is a continuous variable from 0.0 to 4.0. The entry GPA represents the GPA the student submitted upon admissions. The GPA can be from either a high school, or, if the student is a transfer student, a college or university. Entry GPA is not required for admissions and therefore several students (n=230) do not have an entry GPA. Nevertheless, for students who have an entry GPA in the sample the mean GPA is 3.33 (SD=5.37) with a minimum GPA of 0.85 and maximum GPA of 4.00.

Transfer and academic characteristics. Transfer and academic characteristics are data that are gathered about the students while they were attending WSU. These data were gathered from the student database system and includes transfer student status, the number of transfer institutions, the number of major changes, whether the student earned a transfer associate's degree, whether the student earned an associate's degree from WSU, if a student ever failed a course, if a student has ever withdrawn from a course, if a student has taken remedial course work, if a student has ever repeated a course, and the GPA at the time the bachelor's degree was conferred. What follows is an overview of each variable.

Transfer students. This is a dichotomous variable where 1 represents a transfer

student and 0 represents a WSU native student. At WSU students are considered transfer students if they have transferred 30 credits or more from a regionally accredited institution (*n*=1,326, 34.5%). If a student transfers less than 30 credits, they are considered native students (*n*=2,518, 65.5%).

Number of transfer institution. This is a continuous variable from 0 to 3. The count will consist of the number of regionally accredited institutions a student attended and transferred course work. The variable will be coded as a continuous variable where 0= no transfer institutions (*n*=2,518, 65.5%), 1= one transfer institution (*n*=582, 15.1%), 2= two transfer institutions (*n*=458, 11.9%), and 3= three or more transfer institutions (*n*=285, 7.4%). The latter group is few, and therefore combined into one group of three or more institutions.

Number of major changes. This is a continuous variable of the number of times a student changes their major during their academic career. Students who are accepted to WSU must choose a program of study at the point of admissions. WSU is primarily an open enrollment institution. However, some programs require admission to the program. Therefore, a student may be accepted to the institution but not to a program. Students who are not accepted to a selective program must choose another program of study until they are accepted. The academic departments manage student major changes. Students who want to change their major must visit the academic department. The number of major changes will consist of distinct changes to the student's program of study represented as a continuous variable.

Transfer associate degree. This is a dichotomous variable indicating if a student has earned one or more associate's degrees from another institution. The majority of

students did not transfer an associate's degree (*n*=2,924, 76.1%), whereas 919 (23.9%) students did transfer an associate's degree.

WSU associate degree. This is a dichotomous variable indicating if a student has earned one or more associates' degrees from WSU. The number of students who did earn an associate's degree from WSU is 1,401 (36.5%), whereas 2,442 (63.5%) did not earn an associate's degree from WSU.

Failed a course. This is a dichotomous variable indicating if a student has ever failed a course with a letter grade of "E" or "UW" (*n*=1,320, 34%). A failed course is included in the GPA calculation but cannot be used toward total credits required for graduation. An "E" indicates that a student fully attended the course and completed the final. The "E" grade is synonymous with a letter grade of "F" at other institutions. A grade of "UW" indicates that a student unofficial withdrew from the course, or in other words, the student stopped attending the course or did not take the final without officially withdrawing from the course in the registration system.

Withdrew from a course. This is a dichotomous variable indicating if a student withdrew from a course after the beginning of the third week of the semester (*n*=1,426, 37.1%). Withdrawn courses are indicated on the transcript with a "W" as the grade. Withdrawn courses do not count in the GPA and cannot count towards total semester credit hours required for a degree.

Remedial course. This is a dichotomous variable indicating if a student enrolled and completed a remedial course in Math or English (*n*=842, 21.9%). WSU remedial courses are numbered below 1000. For example, MATH 0990 is a remedial course as indicated by the course number 0990. Remedial courses do not count in the student's

GPA and cannot be used towards total credit required for a degree.

Repeated a course. This is a dichotomous variable indicating if a student has ever repeated a course (n=2,030, 52%). A repeated course is a course that can only be taken once for credit but a student has taken the same course, indicated by the same subject and number, again. Courses that are repeated are excluded from the GPA and cannot be used towards total credit for a degree. Some courses do allow students to take a course more than once for credit, these courses are considered repeatable courses and are not included in this variable calculation.

Graduation GPA. This is a continuous variable from 0.0 to 4.0. The graduation GPA is the cumulative GPA when the degree was conferred. The average GPA is 3.38 (SD= .366) with the maximum GPA of 4.0 and the lowest GPA of 2.12. All 3,843 students had a graduation GPA with no missing variables.

Curriculum structure. The final group in the hierarchical regression consists of one independent variable, curriculum structure. The curriculum structure consists of general education requirements, major requirements (including emphasis), minor requirements, and free electives.

For this study, continuous variables represented as a percentage is calculated based on the number of free electives in the program of study. Free electives are credits that are required to meet the minimum total credit hours for the degree but is not required for general education, the major, or the minor. For example, if a program of study consists of 41 credit hours in general education requirements and 48 credit hours in major requirement and 15 credit hours in minor credit hours, totaling 104 required credit hours a student must complete 161 free elective hours to reach the minimum if 120 credit hours.

What follows is the formula to calculate the curriculum structure.

Curriculum Structure Formula (8)

GE + MJ + m = X

X – 120 = FE*

(FE/120)100 = Percentage

** If the result is a negative number the FE will be converted to 0 for the remainder of the formula*.

Curriculum Structure Formula Example (9)

41 + 48 + 15 = 104

104 -120 = 16

(16/120)100 = 13.3%

All bachelor's degrees require a minimum of 120 credit hours. However, each program of study is structured differently. Some programs of study allow for free electives, which the student can fulfill with any earned credit hours not counting towards other requirements. Nevertheless, there are other programs of study that do not allow for free electives, and the requirements are scripted for the total 120 credit hours. Furthermore, some programs go well beyond the minimum 120 credit hours and can require up to 130 credit hours or beyond. For the calculation for these programs, the ratio will be comprised of the required credit versus free electives.

The average percentage of free electives in a program of study is 10.32% (*SD*=10.78) with a maximum percentage of 43.33% and minimum of 0% of free electives in a program of study. Conversely, 1,241 (32.3%) of student who graduated in the sample group did not have any free electives in their program of study.

Coding Variables

Regression analysis can be used with either continuous or dichotomous IVs. A variable that is initially discrete can be used if converted into a set of dichotomous variables (Tabachnick et al., 2001). Converting variables is accomplished by dummy coding the variables (see Table 3 at the end of the chapter).

Statistical Analysis

As mentioned previously regression analysis is the primary method for analysis. Nevertheless, other statistical techniques will be used in addition to regression analysis.

Descriptive statistics

The first level a statistical analysis utilized descriptive statistics. Measures of central tendency, including the mean were calculated for the dependent and independent variables, as appropriate. Likewise, measures of standard deviation and range were calculated for continuous variables. Frequency and percentage data were provided for dichotomous variables. Table 4 at the end of the chapter details the descriptive characteristics for the overall sample.

Student demographic and precollege academic characteristics

This study explored six different demographic and precollege variables. Summary data for these variables are provided in Table 4 at the end of the chapter. More than half of the study were female (52.6%).

The age of the students was calculated at the point of graduation. The average age was 27.59 (*SD*= 6.66) the range of age at graduation varied from 17 to 63 years old.

Race and ethnicity were divided into five groups White, Hispanic, Nonresident,

Unknown, and Other. The overwhelming majority of students were White (76.7%). While the next largest group of students was reported as Unknown (7.3%). For these students, the race/ethnicity was self-reported in the student database system, at the point of admissions, as Unknown. Unfortunately, more accurate race/ethnicity was not available. Federal grant was used to determine financial need and socioeconomic status. The majority of students (61.4%) who graduated had received or qualified for a federal grant.

Transfer and academic characteristics

Over a third (34.5%) of the sample population transferred from another institution. Of those students 582 (15.1%) transferred from one institution, 458 (11.9%) transferred from two institutions and 285 (7.4%) transferred from three or more institutions. A number of students who transferred earned an associate's degree (919, 23.9%).

Over half (56.2%) of all students, both native and transfer, earned an associate's degree before graduating with bachelor's degree. Over a third (36.5%) of the sample population earned an associate's degree from WSU.

Students in the sample changed their major on average 3.17 (SD=0.54) times. The most students changed their major was 12 times during their academic career, whereas the minimum number of major changes was one.

Based on transcript data, the average attempted hours when a student graduated was 163.59 (SD=30.76). The least number of attempted hours was 119, whereas the most attempted hours by one student was 383.1 credit hours. The transcript data further revealed that 1,320 (34.3%) failed a course during their academic career. Over a third

(1,426, 37.1%) of the students in the sample withdrew from a course after the third week of the semester. Over half (2,030, 52.8%) of the students repeated at least one course. Less than a fourth (842, 21.9%) enrolled in a remedial Math or English course. The overall average GPA at graduation was 3.38 (*SD*=0.37), with the lowest GPA at 2.12 and the highest at 4.0. It is important to note that no student can graduate with a Bachelor's degree with a GPA below 2.00.

Curriculum structure

The curriculum structure is based on the percentage of free electives available in a student's program of study. The percentage of free electives will depend on what major, concentration and minor a student declares. Nonetheless, the students in the sample averaged 10.32% (*SD*=10.78) free electives in the program of study. The minimum percentage of free electives in the program of study was 0% and the maximum was 43.3%.

Bivariate Correlation

For research question 1, a Pearson product-moment correlation analysis for continuous variables and a Point Biserial Correlation analysis for dichotomous variables were employed. Bivariate correlation assesses the degree to which the IVs and DV are related. "Correlation is the measure of the size and direction of the linear relationship between two variables, and squared correlation is the measure the strength of the association between them" (Tabachnick et al., 2001, p. 53), whereas regression is used to predict a score on one variable from a score on the other.

A Pearson correlation coefficient is a simple and straightforward way to measure

correlation; it is a standardization measure of the strength of the relationship between variables. For example, if comparing GPA and the GEI, the hypotheses is the higher the GPA, the GEI would also be higher. The comparison is represented by a correlation coefficient, and can range from -1 to 1. A value close to 1 indicates a positive correlation, where x increases y will also increase. Values close to -1 indicates a negative relationship between the variables, where x increases y decreases. Values close to zero imply that as one variable changes the other does not change at all or very little indicating a weak relationship between the variables (Tabachnick et al., 2001). Pearson correlation coefficient is represented by the following equation:

$$r = \frac{1}{n-1} \sum \frac{(x_i - \overline{X})(y_i - \overline{Y})}{s_x s_y} \tag{10}$$

Point Biserial Correlation is a special case of Pearson correlation and is used when one of the two variables are dichotomous (i.e., it is categorical with only two categories). The point biserial correlation coefficient quantifies the relationship between a continuous variable and a variable that is dichotomous (Field, 2009). An example of a dichotomous variable is gender; there are two categories male or female. The male students are coded as 0 and the female students are coded as 1. International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) automatically accounts for dichotomous variables when the Pearson correlation is used.

Regression Analysis

For research questions 2, 3, and 4 a multivariate analysis (multiple regression) was employed. Multiple regression is used to predict the value of the DV from several continuous or dichotomous IVs. There are three analytic approaches in multiple

regression analysis: standard multiple regression, sequential (hierarchical) regression, and statistical (stepwise) regression. The differences among the strategies affect the overlapping variability due to how the IVs are correlated and if the literature determines the order of the how the IVs are entered into the equation (Tabachnick et al., 2001).

In standard multiple regression, all variables are entered into the equation simultaneously. Each IV is then evaluated based on what it adds to the prediction of the DV. Whereas in sequential multiple regression, sometimes called hierarchical regression, the IVs enter the equation in an order specified by the researcher. The order is often determined by theory or literature related to the study. On the other hand, statistical regression, often referred as stepwise regression, enters variables into the equation based on statistical criteria. Controversy surrounds this method because the meaning or interpretation of the variables is not relevant (Tabachnick et al., 2001).

Each variable has a different meaning and effect on the equation based on how it is entered. Therefore, hierarchical regression will be used for the analysis. Variables were entered into the equation in blocks beginning with the demographics and precollege academic characteristics, and then followed by transfer and academic characteristics. The final variable entered into the equation was the curriculum structure.

The results of the analysis will identify which variables were significant. The variables that were significant provide information on the overall problem. With the information, administrators and researchers can then develop policies to minimize the adverse effects of the problem situations.

Regression Model Diagnostics

In addition to theoretical considerations, the use of multiple regression requires that several practical matters be evaluated including the ratio of cases to IVs, outliers, multicollinearity and singularity, and normality, linearity, homoscedasticity of residuals. The ratio of cases to IVs is an equation to determine if the sample size is large enough. Research suggests the following equations for testing the multiple correlation $N \geq 50+8m$ (where m is the number of IVs) and individual predictors $N \geq 104 + m$ (Tabachnick et al., 2001).

"Extreme cases have too much impact on the regression equation and also affects the precision of estimation of the regression weights" (Tabachnick et al., 2001, p. 117). The extreme cases are called outliers. In the initial screening runs, outliers can be seen as cases far from the mean and unconnected with other cases on either plots or z-scores.

Outliers were identified by using Cook's Distance and Statistical Leverage. The first initial analysis of the data identified an incorrectly entered high school GPA for one of the subjects. The high school GPA could not be corrected. Therefore, it was deleted from the data set. The data were then reanalyzed for outliers. The Cook's Distance identified four cases. The subjects were reviewed and determined that the data were in an acceptable range when compared to nonoutliers, and thus determined not to be outliers. Furthermore, the leverage analysis identified only one outlier. The outlier did not match any of the Cook's Distance cases. The case was reviewed and determined to be acceptable to remain in the data set.

There were 299 subjects with missing race and ethnicity data. The models were analyzed with the missing cases included and with the missing cases not included. The

results of the analysis revealed that the missing cases had no effect on the model. Therefore, the missing cases were included in the final model. Multicollinearity is when two or more variables are closely linearly related (Field, 2009). To draw an accurate conclusion about the sample there should not be perfect multicollinearity between two or more of the predictors. A correlation matrix of all the predictors will be run to scan for multicollinearity correlation above .80 will be considered to be of concern. Another method to check multicollinearity is to assess the tolerance statistic values below 0.2 are of concern (Field, 2009). The analysis did not reveal any cases of multicollinearity.

Normality, linearity, and homoscedasticity of the residuals can be evaluated with a scatterplot diagram. Assumptions of analysis are that the residuals are normally distributed about the predicted DV scores, that there is a straight-line relationship with the predicted DV scores, and the variance of the residuals is the same for all predicted scores (Tabachnick et al., 2001). The scatterplot diagram revealed that the data were evenly distributed and no issues were identified (see Appendix A).

Table 2
Enrollment by race and ethnicity at Weber State University

	Degree-seeking Undergraduates	Total Undergraduates (both degree and non-degree seeking)
Nonresident (US)	370 (2.08%)	368 (1.45%)
Hispanic/Latino	1,707 (9.59%)	2,405 (9.49%)
Black or African American, non-Hispanic/Latino	314 (1.76%	317 (1.25%)
White, non-Hispanic/Latino	12,323 (69.25%)	12,659 (49.97%)
American Indian or Alaska Native, non-Hispanic/Latino	90 (0.51%)	93 0.37%)
Asian, non-Hispanic/Latino	299 (1.68%)	311 (1.23%)
Native Hawaiian or other Pacific Islander, non-Hispanic/Latino	96 (0.54%)	97 (0.38%)
Two or more races, non-Hispanic/Latino	411 (2.31%)	422 (1.67%)
Race and/or ethnicity unknown	2,185 (12.28%)	8,645 (34.12%)
Total	17,795	25,335

Table 3
Coding of variables

Variable	Variable Name	Definition	How Measured	Hierarchical Grouping
Gender	GENDER	Student Gender: Derived from the students response on the admissions application	Dichotomous; Male = 0 Female = 1	Demographics and Precollege Academic Characteristics
Age	AGE_AT_ GRADUATION	The age of the student at the time they graduated	Continuous	Demographics and Precollege Academic Characteristics
Race/Ethnicity	HISPANIC NONRESIDENT UNKNOWN OTHER	Derived from the student's response on the admissions application. Other includes Black, American Indian, Asian, Pacific islander and two or more races.	Dichotomous; Dummy coded with White Students as the reference group	Demographic and Precollege Academic Characteristics
High School Dual Enrollment Programs	PARTIC_DUAL_ PROGRAM	Students who participated in concurrent enrollment, early college, Advance Placement or International Baccalaureate programs.	Dichotomous: Did not participate = 0 Participated = 1	Demographic and Precollege Academic Characteristics
Entry GPA	ENTRY_GPA	Student's entry GPA based on high school transcripts or previous college transcripts.	Continuous; Range from 0.0 to 4.0	Demographic and Precollege Academic Characteristics
Pell Grant Eligibility	FEDERAL_GRANT	Derived from student's FASFA applications	Dichotomous; Did not receive a Pell Grant = 0 Received a Pell Grant = 1	Demographic and Precollege Academic Characteristics
Transfer Student	TRANSFER_STUDENT	Students who have transferred 30 or more credits to WSU	Dichotomous; Native Student = 0 Transfer Student = 1	Transfer and Academic characteristics s
Number of Transfer Institutions	NUMBER_ TRANSFER_INST	Number of previous institutions a student has attended	Grouped; 1 institution, 2 institutions and 3 or more institutions	Transfer and Academic characteristics s
Number of Major Changes	NUMBER_ MAJOR_CHANGES	The number of times a student has changed their major	Continuous	Transfer and Academic characteristics s
Transfer Associate's degree	TRANSFER_ ASSOCIATE	Students who have earned an associate's degree from another institution and transferred it to WSU	Dichotomous; No Transfer Associate's degree = 0, Transfer Associate's degree = 1	Transfer and Academic characteristics s
WSU Associate's degree	WSU_ASSOCIATE	Students who have earned an associate's degree at WSU	Dichotomous; No WSU Associate's Degree = 0 WSU Associate's Degree = 1	Transfer and Academic characteristics s
Ever Failed a Course	E_OR_UW_EVER	Student who have ever failed a course. UW indicates an unofficial withdraw, which is equivalent to failing the course. E is the official grade for failing the course	Dichotomous; Did not fail a course = 0 Failed a course = 1	Transfer and Academic characteristics s
Withdrew from a Course	W_EVER	Students who ever withdrew from a course after the third week of the semester.	Dichotomous; Did not withdraw from a course = 0 Withdrew from a course = 1	Transfer and Academic characteristics s
Ever Taken a Remedial Course	REMEDIAL_EVER	Students who registered for a course in MATH 0950, MATH 0960, MATH 0990, MATH 1010, ENGL 0900, ENGL 0955, or ENGL 0960	Dichotomous; Did Not Registered for a Remedial Course = 0 Registered for a Remedial Course = 1	Transfer and Academic characteristics s
Ever Repeated a Course	REPEAT_COURSE	Student who have ever repeated a course	Dichotomous; Did Not Repeat a Course = 0 Repeated a Course = 1	Transfer and Academic characteristics s
Graduation GPA	GPA_OVERALL	The GPA at the time the student graduated	Continuous variable from 0.0 to 4.0	Transfer and Academic characteristics s
Percentage of free electives in the Program of Study	PRECENT_FREE_ ELECTIVEX100	The percentage of free electives in a program of study	Continuous	Curriculum Structure

Table 4

Descriptive characteristics of the sample

Measures	N	%	Mean	SD	Min	Max
Demographic and Precollege Academic Characteristics						
Gender						
Male	1,821	47.4				
Female	2,022	52.6				
Age at Graduation	3,843	100	27.59	6.66	17	63
Race and Ethnicity						
White	2,947	76.7				
Hispanic	244	6.3				
Nonresident	143	3.7				
Unknown	299	7.8				
Other	210	5.5				
Dual Enrollment Programs	1,323	34.4				
Entry GPA	3,613	94.0	3.33	0.54	0.85	4.00
Federal Grant	2,360	61.4				
Transfer and Enrollment Behaviors						
Transfer Student	1,325	34.5				
Number of Transfer Institutions						
Did not Transfer	2,518	65.5				
One Transfer Institution	582	15.1				
Two Transfer Institutions	458	11.9				
Three or More Transfer Institutions	285	7.4				
Number of Major Changes	3,843	100	3.17	1.53	1	12
Transferred an Associate’s Degree	919	23.9				
Earned a WSU Associate Degree	1,401	36.5				
Total Associate's Degrees	2,161	56.2				
Failed a Course	1,320	34.3				
Withdrew from a Course	1,426	37.1				
Remedial Course	842	21.9				
Repeated a Course	2,030	52.8				
Graduation GPA	3,843	100	3.38	0.37	2.12	4.00
Overall Attempted Hour	3,843	100	163.59	30.76	119	383.1
Curriculum Structure						
Percentage of Free Electives in a Program of Study	3,843	100	10.32	10.78	0	43.3

CHAPTER IV

ANALYSIS AND PRESENTATION OF DATA

This chapter will share the findings of each of the four research questions examining variables that influence graduation efficiency. The four research questions were the following:

1. What is the bivariate correlation among the GEI and:
    (a) demographic and precollege academic characteristics (i.e., gender, age at graduation, race/ethnicity, dual enrollment programs, entry GPA, and Pell Grant eligibility),
    (b) student transfer and academic characteristics (i.e., transfer students, number transfer institutions, the number of major changes, transfer associate degree, WSU associate degree, failed a course, withdrew from a course, remedial course, repeated a course, and GPA at graduation) and;
    (c) curriculum structure (percentage of free electives in the program of study)?
2. Do demographic and precollege academic characteristics predict degree efficiency?
3. Controlling for demographic and precollege academic characteristics, do transfer and academic characteristics predict the GEI?
4. Controlling for demographic, precollege academic characteristics, transfer, and

academic characteristics, does the curriculum structured predict the GEI?

The purpose of this study is to identify variables that contribute to efficient or inefficient degree pathways for students who graduated with a bachelor's degree from WSU. This research looked at 21 predictive variables divided into three groupings: demographic and precollege academic characteristics, transfer and academic characteristics, and curriculum structure. The dependent outcome variable for this study is the graduation efficiency index score developed by Gillmore and Hoffman (1996) and described in Chapter 3. The results in this chapter are presented in the order of the four research questions beginning with bivariate correlation followed by hierarchical regression analysis.

Regression Analysis

Hierarchal multiple regression techniques were used to analyze the relationship between the independent variables (IV) and the dependent variable (DV). Multiple regression uses several IVs to predict a value on a DV for each subject (Tabachnick & Fidell, 2001). The result is an equation that represents the best prediction of a DV from several continuous or dichotomous IVs.

It is important to check the assumptions of the model. Specific diagnostic tests were performed to determine the fit of the regression model; these tests include outliers among the IVs and DV, the absence of multicollinearity and an examination of normality, linearity and homoscedasticity of residuals. No assumptions were violated. A detailed review of assumptions can be found in Appendix A.

In hierarchal multiple regression or also call sequential regression, the IVs enter the equation in a specific order specified by the researcher (Tabachnick & Fidell, 2001;

Field, 2009). The IVs for this study were assessed in terms of what each add to the equation at its point of entry. The initial models for each research question can be found in Appendix B. After the initial models were run, the least statistically significant variables were removed from the model one by one until all predictors were found to be statistically significant and the final model was reached.

Question 1: Correlation Findings

The Pearson product-moment correlation coefficient is measured on a standard scale ranging between -1.0 and +1.0. The coefficient represents an effect size, which indicates the strength of the relationship between two variables. Cohen's (1988) conventions of the effect size correlation coefficient suggest that a value of .50 or larger represents a strong relationship between two variables, a value of .10 represents a weak or small relationship, and a value of .30 is considered to have a moderate relationship. Table 5 at the end of the chapter displays the bivariate correlation among the IVs and DV.

Bivariate correlation among demographic and precollege academic characteristics and the GEI.

Research question 1a addressed the bivariate relationship among the demographic and precollege academic characteristics and the GEI. None of the variables was found to correlate strongly with the GEI. The correlation between Hispanic and the Unknown Race/Ethnicity variables and GEI was not statistically significant. There was a negative correlation between age at graduation and GEI, $r = -.26$, $p < .001$, which is the largest of the effect sizes of the first group of variables. However, the effect size is relatively small,

when compared to Cohen's (1988) conventions of effect sizes, indicating the relationship is weak. Nevertheless, Figure 3 at the end of the chapter indicates the weak relationship as students get older the GEI decreases. Dual enrollment programs (r_{pb} = .23, p < .001) and entry GPA (r = .22, p < .001) also indicated a positive statistically significant but weak relationship with GEI. Gender (r_{pb} = .07, p < .001), federal grant (r_{pb} = .05, p < .001), and nonresident (r_{pb} = .06, p < .001) were statistically significant but the effect size was far too weak to indicate a practical relationship with the GEI.

Bivariate correlation among transfer and academic characteristics and the GEI.

Research question 1b addresses the bivariate relationship among transfer and academic characteristics and the GEI. The GPA at graduation had the largest effect size (r = .32, p < .001), which was moderately correlated to the GEI. The results indicate as GPA increased so did the GEI score, as represented in Figure 4 at the end of the chapter. Variables related to transfer including transfer student status (*rpb* = -.23, p < .001), number of transfer institutions (r = -.25, p < .001), and earning a transfer associate's degree (*rpb* = -.15, p < .001), had a weak to slightly moderate negative relationship to the GEI. Academic characteristics including failing a course (*rpb* = -.26, p < .001), withdrawing from a course (*rpb* = -.21, p < .001), and repeating a course (*rpb* = .23, p < .001), had a weak to slightly moderate negative relationship to the GEI. Completing a remedial course (*rpb* = -.08, p < .001), though statistically significant, had a very weak relationship to the GEI. Earning an associate's degree at WSU did not have a statistically significant relationship to the GEI.

Hierarchical Regression Analysis

Research questions 2, 3, and 4 were answered using hierarchical regression analysis. In hierarchical regression analysis, the researcher specifies how the IVs are entered into the model. The order of entry of the IVs is assigned according to logical and theoretical considerations (Field, 2005; Tabachnick & Fidell, 2001). A three stage hierarchical multiple regression was conducted with GEI as the dependent variable. Demographic and precollege academic characteristics (i.e., gender, age at graduation, race/ethnicity, dual enrollment programs, entry GPA and federal grant eligibility) were entered at stage one. In the second stage, transfer and academic characteristics (i.e., transfer student, number of transfer institutions, number of major changes, transfer associates degree, WSU associates degree, failed a course, withdrew from a course, remedial course, repeated course, and GPA at graduation) were entered in addition to Demographic and Precollege Academic Characteristics. In the third stage, Curriculum Structure (i.e., Percentage of Free Electives in a Program of Study) was added to the model with Demographic, Precollege Academic Characteristics, and Transfer and Academic Characteristic. The regression statistics for the final model are presented in Table 6 at the end of the chapter and the results of the full model results are presented in Appendix B.

Question 2: Hierarchical Regression Analysis Stage One – Demographic and Precollege Academic Characteristics

The first stage model included 6 IVs that were statistically significant: gender, age at graduation, race/ethnicity, dual enrollment programs entry GPA and federal Pell grant status. The overall model was significant, $F(6, 3607) = 66.391$, $p < .001$), and the model

accounted for 11% ($R^2 = 0.11$) of the variation in the GEI. Three independent variables (Hispanic, Other race/ethnicity, and unknown race/ethnicity) were not significant and were removed from the regression equation one by one until all remaining variables were deemed significant. The remaining significant variable related to race/ethnicity was nonresident ($\beta = -3.701$, $p < .01$), which negatively predicts the GEI. Relative to students who did not participate in dual enrollment, participating in dual enrollment was more efficient by 2.5% ($\beta = 2.519$, $p < .001$). Female students, as compared to male students, were more efficient by 1% ($\beta = 0.981$, $p < .05$). Higher entry GPAs were more efficient than lower entry GPAs by 2.7% ($\beta = 2.686$, $p < .001$).

On the other hand, nonresident students, as compared to resident students, were less efficient by -3.7% ($\beta = -3.701$, $p < .01$). Furthermore, older students were less efficient than younger students by -0.4% ($\beta = -0.355$, $p < .001$) for each year of the student's age. Relative to students who were not eligible for federal Pell grants, students who qualified for the federal Pell grant were less efficient than non-Pell grant students the GEI score by -1.2% ($\beta = -1.211$, $p < .01$).

Question 3: Hierarchical Regression Analysis Stage Two – Transfer and Academic Characteristics

The second stage model introduced the transfer and academic characteristics variables and increased the overall explained variance to 32% ($R^2 = 0.317$) $F(14, 111.141) = 111.416$, $p < .001$. Accounting for demographic and precollege academic characteristics, the only transfer and academic characteristics variable that positively predicted the GEI was GPA at graduation ($\beta = 5.799$, $p < .001$). A one-point increase in GPA at graduation resulted in a more efficient GEI by 5.8%.

The other eight transfer and academic characteristics variables were also statistically significant but were negative predictors of the GEI. In respect to native students, transfer students were less efficient by -1.7% (β = -1.706, $p < .05$). Additionally, for each institution a student transferred from resulted in a -3% (β = -2.979, $p < .001$) less efficient GEI score. Moreover, students who transferred with an associate's degree decreased the GEI by -4.4% (β = -4.356, $p < .001$).

Once the student (both transfer and native) was in attendance at WSU, each time the major change resulted in a less efficient GEI score by -1.5% (β = -1.521, $p < .001$). Additionally, a student who earned an associate's degree at WSU were less efficient than student who did not earn an associate degree by -2.4% (β = -2.394, $p < .001$). A student who has ever failed a course was less efficient by -2.2% (β = -2.240, $p < .001$), whereas a student who withdrew from a course was less efficient by =3.6% (β = -3.603, $p < .001$). A student who ever repeated a course was less efficient by -4.8% (β = -4.833, $p < .001$). The independent variable Remedial was not significant and was removed from the equation.

When accounting for demographic and precollege academic characteristics in stage two of the multiple regression analysis, the three variables that were significant in stage one not found to be statistically significant in stage two: gender, entry GPA and federal Pell grant status. Nevertheless, age at graduation (β = -0.334, $p < .001$) remaining at 4%, Nonresident (β = -5.179, $p < .001$) further decreasing the GEI score by 5.2% as compared to the previous model of 3.7% and dual enrollment programs (β = 1.572, $p < .01$) increased the GEI score by 1.6% as compared to the previous model of 2.5%, all remained significant.

Question 4: Hierarchical Regression Analysis Stage Three – Curriculum Structure

The third stage model added the primary variable of interest after controlling for demographic and precollege academic characteristics and transfer and academic characteristics. Curriculum Structure only explained an additional 0.02% of the variation of the GEI, suggesting a minimal influence on the overall variation in the GEI. The percentage of free electives in the program of study ($\beta = 0.09$, $p < .001$) was a significant predictor. However, the increase is very small as compared with the other significant variables. Nevertheless, if a student was in a program of study in which 20% of the requirements were free electives, the student would be more efficient by 1.8%.

When all variables were included in stage three of the regression model, gender, race/ethnicity, entry GPA, federal Pell grant status, and remedial courses were not significant predictors of the GEI. The final model included age at graduation (-0.3% per year), nonresident (-5.7%), dual enrollment (1.7%), transfer student (1.7%), number of transfer institutions (-3% per institution), number of major changes (-1.5% per major change), transfer associate's degree (-4.5%), WSU associate's degree (-2.6%), failed a course (-2.3%), withdrew from a course (-3.6%), repeated a course (-4.8%), GPA at graduation (5.7% per GPA point), and curriculum structure (.09% per percent of free electives) all had a significant effect on predicting the GEI.

The most important predictor of the GEI was GPA at graduation (5.7%, $\beta = 5.688$, $p < .001$). Very few students were considered nonresident. Nevertheless, the Nonresident variable has a meaningful negative impact (-5.7%, $\beta = 5.709$ $p < .001$) on the GEI for those students who were nonresidents (US). Furthermore, students who transfer will have other characteristics associated with transfer. A transfer student must have at least one

transfer institution to be considered a transfer student. Therefore, the effect of transferring on the GEI may include characteristics such as transfer student, which has a -1.7% on the GEI and at least one transfer institution, which has a -3% on the GEI. Additionally, a student who transfers an associate's degree (-4.5%), which requires that a student is also a transfer student (-1.7%) and transfer from at least one institution (-3%) can have a profound effect on the GEI.

Limitations of the Study

Several limitations of this study must be considered when interpreting the results. The data were collected from one institution, and the generalizability of the study is limited to similar institutions and geographic areas. A second limitation is that the sample included only students who graduated from WSU. Therefore, efficiency is biased towards students who have completed a bachelor's degree, and the results may not apply to students who have not completed a bachelor's degree.

Because some variables are dichotomous, indicating if a student participates in a program or exhibited a particular behavior, the intensity or dosage of participation or the behavior cannot be determined for several variables including, dual enrollment programs, failing a course, withdrawing from a course, remedial course, and repeating a course. For example, a student who withdrew from one course is considered the same as a student who withdrew from 10 courses. More nuanced data on the intensity or dose of participation or behaviors might provide different information and change the regression results.

When the data were initially extracted from WSU's student database system, race/ethnicity was tracked on an outdated form in the system. The outdated form did not

account for the variations of race/ethnicity resulting in many students labeled as unknown. An upgrade to the data system implemented a more sophisticated form for race/ethnicity. The administration and data stewards later discovered the error and a correction to the data is being implemented. Unfortunately, the resolution of the data was not implemented in time for the completion of this study. The correction to the database system would have more accurately placed students who were in the unknown category into a race/ethnicity category.

A large majority of students at WSU participate in remediation. However, only 21% of students in the sample participated in remediation. The sample may be biased towards successful completion of remediation. Further research is needed to determine the true effect of remediation and the GEI.

Table 5

Pearson correlation matrix of variables between GEI scores, demographic, precollege academic characteristics, transfer, academic characteristics, and curriculum structure

	Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	#
1	GEI Index Score	1																				
	Demographics and Precollege Characteristics																					
2	Gender	.07***	1																			
3	Age at Graduation	-.26***	-.01	1																		
4	Hispanic	-.001	.001	-.03*	1																	
5	Nonresident	-.06***	-.02	-.08***	-.04**	1																
6	Unknown	-.001	-.001	-.001	-.07***	-.05**	1															
7	Other	-.04**	-.03*	-.04**	-.05***	-.04**	-.05***	1														
8	Dual Enrollment Programs	.23***	.08***	-.42***	.001	-.13***	.02	-.05***	1													
9	Entry GPA	.22***	.20***	-.27***	-.03*	-.19***	.01	-.06***	.35***	1												
#	Federal Grant	-.05***	-.06***	.05***	.05***	-.22***	-.04**	.00	-.04**	-.03*	1											
	Transfer and Enrollment Behaviors																					
#	Transfer Student	-.23***	.03*	.31***	-.02	.16***	-.06***	.04**	-.41***	-.06***	-.06***	1										
#	Number of Transfer Institutions	-.25***	.55***	.33***	-.02	.05***	-.05***	.04**	-.37***	-.13***	-.05**	.87***	1									
#	Number of Major Changes	-.04**	-.06***	-.20***	.001	-.16***	.02	-.04**	.38***	.14***	.13***	-.50***	-.43***	1								
#	Transfer Associate Degree	-.15***	.04**	.22***	-.01	-.05***	-.05**	.04**	-.25***	-.01	-.02	.54***	.51***	-.35***	1							
#	WSU Associate Degree	.001	.15***	-.05***	.02	-.13***	.04**	-.04**	.15***	.17***	.07***	-.23***	-.15***	.33***	-.22***	1						
#	Failed a Course	-.26***	-.15***	-.01	.02	.03*	.03*	.02*	-.04**	-.24***	.05***	-.21***	-.21***	.17***	-.22***	.06***	1					
#	Withdrew From a Course	-.21***	-.12***	-.04**	.01	.05**	.02*	.001	-.01	-.14***	.03*	-.18***	-.17***	.17***	-.19***	-.05**	.34***	1				
#	Remedial Course	-.08***	-.06***	.03*	.04**	.001	.04**	.001	-.08***	-21***	.08***	-.28***	-.24***	.14***	-.24***	.02	.29***	.20***	1			
#	Repeated Course	-.23***	-.13***	-.11	.03*	.06***	.03*	.001	.04**	-.16***	.05***	-.29***	-.30***	.21***	-.31***	.001	.58***	.29***	.29***	1		
#	Graduation GPA	.32***	.24***	-.04**	-.04**	-.05***	-.03*	-.11***	.16***	.50***	-.01	-.04**	-.03*	.001	.04**	.21***	-52***	-.30***	-.21***	-.42***	1	
	Curriculum Structure																					
#	Percentage of Free Electives	.07***	.21***	-.04**	.02	.10***	-.05***	-.01	-.04**	-.01	-.03*	-.06***	.05**	-.03*	.06***	.07***	-.03*	-.04**	-.01	-.06***	.06***	1

Note: *$p < .05$; **$p < .01$; ***$p < .001$

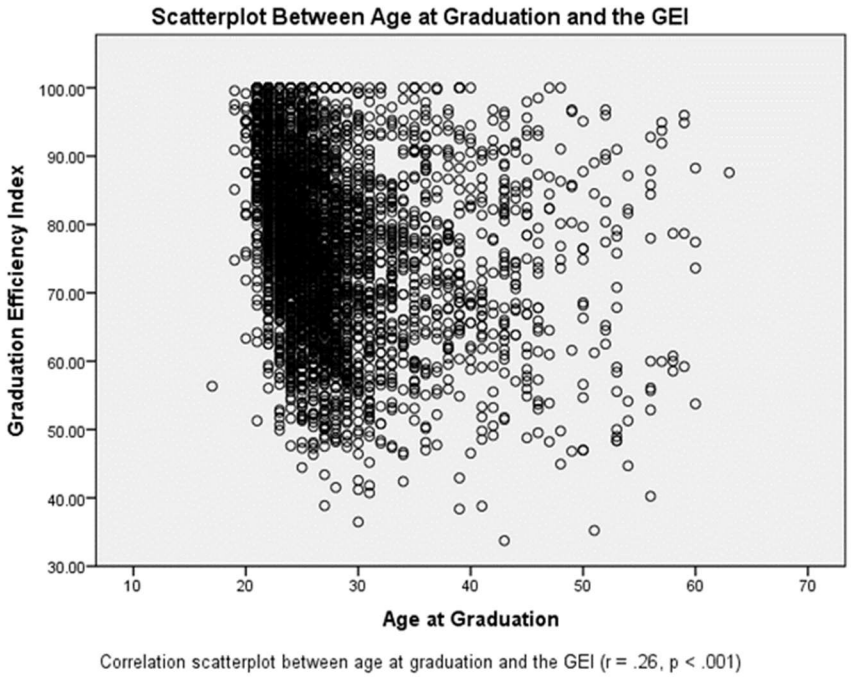

Figure 3 Correlation scatterplot of age at graduation and the GEI.

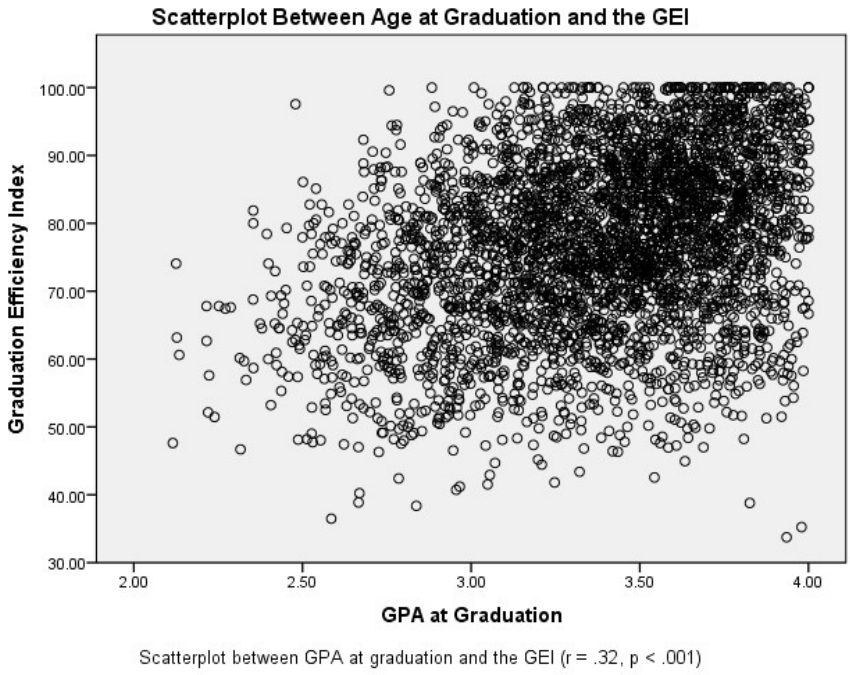

Figure 4 Correlation scatterplot between GPA at graduation and the GEI.

Table 6
Summary of hierarchical regression for variables predicting graduation efficiency

	Model 1			Model 2			Model 3		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	*SE*	β	B	SE	β	B	SE	β
(Constant)	77.688	1.839		82.753	2.460		81.697	2.459	
Gender	0.981*	0.407	0.039	-.092	0.367	-.004	-0.477	0.373	-0.019
Age at Graduation	-0.355***	0.034	-0.189	-0.334***	0.030	-0.178	-0.323***	0.030	-0.171
Nonresident	-3.701**	1.181	-.053	-5.179***	1.083	-0.074	-5.709***	1.084	-0.082
Dual Enrollment Programs	2.519***	0.485	0.095	1.572**	0.461	0.059	1.682***	0.460	0.064
Entry GPA	2.686***	0.415	0.115	-0.557	0.412	-0.024	-0.420	0.411	-0.018
Federal Grant	-1.211**	0.421	-0.47	-0.626	0.373	-0.024	-0.624	0.371	-0.024
Transfer Student				-1.706*	0.831	-0.065	-1.712*	0.828	-0.066
Number of Transfer Institutions				-2.979***	0.381	-0.231	-2.992***	0.379	-0.232
Number of Major Changes				-1.521***	0.144	-0.184	-1.528***	0.144	-0.185
Transfer Associate Degree				-4.356***	0.503	-0.084	-4.507***	0.502	-0.156
WSU Associate Degree				-2.394***	0.406	-0.091	-2.566***	0.406	-0.098
Failed a Course				-2.240***	0.503	-0.084	-2.322***	0.502	-0.087
Withdrew From a Course				-3.603***	0.398	-0.138	-3.579***	0.397	-0.137
Repeated a Course				-4.833***	0.460	-.192	-4.755***	0.458	-0.189
GPA at Graduation				5.799***	0.664	.168	5.688***	0.662	0.165
Percentage of Free Electives							0.087***	0.017	0.074
R^2	0.105			0.317			0.319		
F	70.695			123.722			27.066		
ΔR^2				0.212			0.005		

***Note**: *p < .05; **p < . 01; ***p < .001*

CHAPTER V

DISCUSSION

In this chapter, the significant findings from this study are organized into three sections. The first section provides a summary of the findings, including, how the findings complement or add to existing research in the field. The second section explores the implications of this study for practice and policy, and the last section makes recommendations for future research.

Discussion of Findings

As stated previously, policymakers, students and administrators have a vested interest in graduation efficiency and degree attainment (Anderson & Kim, 2006; Baum et al., 2010; Chen, 2009; Dowd et al., 2009; S. Jones, 2012; Obama, 2009; Pascarella et al., 2005). States and institutions use different methods to measure student or institutional success as it relates to degree attainment and efficiency. Two of the most common measures in the literature are graduation rates (Astin, 2005; Blose, 1999; H. Cohen & Ibrahim, 2008; Cook & Pullaro, 2010; Howard & Rogers, 1991; Jones-White et al., 2010) and time to degree (Hagedorn, 2010; Levin, 2008; Malcom, 2012; Poch, 1998; Poch & Wolverton, 2005). The difficulty with both methods is that they do not identify what problems inhibit a student's ability to be efficient in their pathway to a bachelor's degree. The GEI used in this study is fundamentally different from graduation because it is based

on an analysis of the applicability of credits and the use of students' time while enrolled. This measure is able to account for student-level and institutional-level factors that may influence efficiency. A students' measure of efficiency are based on how adeptly they complete the requirements for the degree, rather than the measure of efficiency derived from a comparison group, such as another institution or a national standard. The policy information generated from this study can be used to determine areas of improvement for the institution and how to better assist students.

This study used problem structuring as a conceptual framework to study problem situations to structure policy problems in relation to degree efficiency (Dunn, 2012). Problem structuring is dependent on reliable information. The first step of problem structuring is sensing that there may be problems, including what variables may contribute to the problem. The problem-sensing step determined there might be problems with degree efficiency because students were graduating with more credit than needed to complete a degree. Problem-situations, identified during the problem-sensing step, are variables that might contribute to the problem of degree efficiency. Problem-situations must be empirically studied to produce information about the effect the problem-situation has on the perceived problem (see Figure 2).

In this study, several problem-situations were identified and empirically studied to develop relevant information about degree efficiency. Using Dunn's (2012) framework, the problem-situations were: (a) demographic and precollege academic characteristics; (b) transfer and academic characteristics; and (c) curriculum structure. Based on the evidence produced from this study, administrators can then structure the policy problem and develop a solution to the problem.

Little research has been conducted to study what variables along the pathway to degree completion predict efficiency (Gillmore & Hoffman, 1997; Lam, 1999; Poch, 1998; Poch & Wolverton, 2005; University of Washington, Provost's Committee on Accountability, 1997; Washburn & Priday, 2003). The purpose of this study was to identify which variables predict degree efficiency, as measured by the GEI. However, the goal of this research was not to define or determine an efficiency threshold. The purpose was to identify which variables positively or negatively influence the GEI. Each variable represents a problem situation that may affect efficiency. A clear picture of the overall efficiency problem can be structured when each situation is better understood.

Careful consideration should be engaged when discussing efficiency in higher education because the sole purpose of higher education is not efficiency. Attending college can have a great impact on a student's life both social and academically (Pascarella et al., 2005). For example, college is an opportunity for students to explore new topics, have transformative experiences, and develop their identity (Cranton, 2006; Keeling, 2004; Mezirow, 2003; Taylor, 2008). College can have a lasting impact on students beyond receiving a degree, and these impacts are at both the individual and societal levels. Higher education benefits to individuals are both monetary and nonmonetary. There is a positive correlation between higher levels of education and higher earnings for all racial/ethnic groups and men and women. Furthermore, college graduates are more likely than others to enjoy employer-provided health insurance and pension benefits. College graduates are less likely to be dependent on social and public assistance programs, are healthier and benefit from employer-paid pensions and health insurance. Moreover, college graduates are more apt to engage in their community by

participating in organized volunteer work, take an interest in voting and the political process, and are more liable to donate blood. Additionally, college-educated adults are more apt to be open to different points of view, and the children of college-educated adults tend to have higher cognitive abilities and are more likely to engage in cultural, athletic, and religious activities (Baum et al., 2010; Pascarella et al., 2005). Institutions should design policies and practices that encourage students to be active consumers of all a college education has to offer (Kuh et al., 2011; Pascarella et al., 2005). For some students, pursuing enriching educational experiences or transformative experiences may not be an "efficient" endeavor, and institutions need to support students' pursuit of these experiences and celebrate their long-term benefits and outcomes to individuals and to society.

As an administrator and University Registrar, I am keenly focused on the use of educational resources and how to ensure students are successful and make progress toward degree completion. I work with the campus community to ensure that supply meets demand in terms of course offerings and other educational resources that students need to complete their degree. I often observe institutional policies and practices as well as student behaviors that are barriers to student success and degree completion. My goal with this study was to assess how institutions can better design policies and practices to support students' pathways to success and better student decision-making.

I believe that "education is a critical component of the American dream of rising living standards from one generation to the next, and of social mobility based on hard work and achievement" (Archibald & Feldman, 2010, p. 7). That dream can only be realized with the completion of a college degree. For the vast majority of college

students, the largest cost of higher education is the opportunity cost of their time, and my interest in this study was to identify the primary factors that influence students' efficiency degree completion. However, as institutions assess efficiencies and inefficiencies, it is incumbent upon them that they understand how creating more efficiencies might negatively influence educational quality, choice, and equity.

The remainder of the chapter presents the summary of findings and is organized by research questions with the first subsection exploring demographics and precollege academic characteristics and their relationship with the GEI. The next section examines the relationship among transfer and academic characteristics and the GEI while controlling for demographic and precollege academic characteristics. The final section explores the impact that curriculum structure has on the GEI while controlling for demographics, precollege academic characteristics, transfer, and academic characteristics. The chapter concludes with recommendations for research and recommendations for policy and practice.

Demographics and Precollege Academic Characteristics

The initial model included the following variables that represented demographic and precollege academic characteristics: gender, age at graduation, race/ethnicity, dual enrollment programs, entry GPA, and federal Pell grant status. In the model with only demographic and precollege academic characteristics gender, age at graduation, nonresident status (US) of race/ethnicity, dual enrollment programs, entry GPA and federal Pell grant status were statistically significant. However, in the model that controlled for transfer and academic characteristics, only age at graduation, nonresident status, and dual enrollment programs remained significant.

Gender

Most studies that examine the relationship between gender and time to degree suggest that women students perform better than men (Astin, 2005; Bowen et al., 2009; DesJardins, McCall, et al., 2002; Jones-White et al., 2010; Kena et al., 2015; Knight, 2004; Lam, 1999). In a study that used the GEI, Gillmore and Hoffman (1997) found that women performed better than men on the GEI by 2.4%. However, this study suggests, when controlling for demographic, precollege academic characteristics, transfer, and academic characteristics, gender was not significant.

Race/ethnicity

It is well documented that White and Asian students graduate in less time than non-White students (Bowen et al., 2009; Knight & Arnold, 2000). However, when examining efficiency using the GEI, none of the race/ethnicity variables were significant when controlling for other demographic and precollege variables. It is important to note that the majority of WSU's student body is White and 299 students are listed as Unknown. Nevertheless, students who attend WSU from another country (nonresidents (US)) are significantly less efficient compared to White students. To illustrate the practical implication of the results, I provide the predicted GEI scores from the regression models for select results throughout the chapter.

For example, let us compare 2 hypothetical students who graduated from WSU. Holding all other independent variables constant, the student who is a nonresident will have a predicted GEI of 82.61%, whereas, the student who is a resident will have a predicted GEI of 88.32%, a difference of approximately 6% (see Figure 5 the end of the chapter). The difference, when compared to standard 120-semester credit hours for a

program of study, equates to about 6 credits or two 3-credit courses.

One explanation for the difference may be that many institutions with English as Second Language (ESL) programs require students with low Test of English as a Foreign Language (TOEFL) exam scores to take additional courses that will increase English proficiency (Cho & Bridgeman, 2012). These additional courses count towards total attempted hours and may not count towards total credits required for the degree. The additional courses are not applicable to degree requirements, which results in a negative effect on the GEI score. Nevertheless, the extra courses are necessary to ensure that the students are successful at the institution.

Age at graduation

Previous research suggests that time to degree is longer for older students than for younger students (DesJardins, McCall, et al., 2002; Gillmore & Hoffman, 1997; Knight, 2004). The findings in this study also suggest older students are less efficient than younger students. As the age of the student at graduation increases, the predicted GEI decreases by 0.3% for each year. For example, compare a student who is 22 years old to a student who is 32 years old, a difference of 5 years above and below the mean of 27 years old. Holding all other variables constant, the student who is 22 years old has a predicted GEI of 90.13%, whereas the student who is 32 years old has a predicted GEI score of 86.89%, a difference of 3.2%, which equate to about 4 credits for a 120 credit hour program of study (see Figure 6 at the end of the chapter).

The difference in efficiency may be due to previously earned credit becoming no longer applicable to the degree they are pursuing. The credits a student earned will never expire from the student transcript, but the applicability of the credit can expire. For

example, programs such as computer science require a course to be completed within the last seven years to be applicable toward a degree (Weber State University Catalog, 2016). Another explanation may be that older students may repeat courses from their past to refresh their understanding of content. Students may repeat courses under their own volition when it is not required of them to meet program of study requirements.

Dual enrollment programs

Students who participate in dual enrollment programs while in high school are more efficient than students who do not. This contributes to previous research that suggests dual enrollees are more likely to persist in college and attain a college degree (An, 2013; Karp et al., 2007; Morrison, 2008; Swanson, 2008; Taylor, 2015), are less likely to participate in remedial math (Kim & Bragg, 2008) and are more likely to be prepared for the rigors of college (Allen, 2010; An & Taylor, 2015; Hoffman et al., 2008).

Controlling for other factors, students, who participated in dual enrollment programs, had GEI scores that were 1.7% higher, on average, than students who did not participate in dual enrollment. The results do not indicate an enormous advantage, only 2 credit hours efficiency gained for a 120 credit hour program of study, in relation to the GEI score. However, when coupled with the other benefits of dual enrollment programs, students who participated gain an advantage when they attend college.

Student academic performance

Entry GPA was significant when controlling only for demographic and precollege academic characteristics. However, this study found when controlling for GPA at

graduation, entry GPA was no longer predictive of the GEI. This finding supports the research of DesJardins, Ahlburg, and McCall (2002) who found that when controlling for college GPA, high school GPA was not predictive of college attainment.

Nevertheless, this study found that GPA at graduation was one of the strongest predictors of the GEI, it being significant and one of the largest coefficients. To illustrate this point further, compare a student who earned a 3.7 GPA to a student who earned 3.0 GPA. Holding all other variables constant, the student with a 3.7 GPA has a predicted GEI of 90.14% whereas the student with a 3.0 GPA has a predicted GEI of 86.16%, a difference of 4%, which equates to about 5 credits for 120 credit hour program of study (see Figure 7 at the end of the chapter).

Federal Pell grant

The proxy for socioeconomic status was whether a student qualified for a federal Pell grant. The majority of students in the sample (61.4%) qualified for the federal Pell grant. In the first model, controlling for demographic and precollege academic characteristics, federal Pell grant was a statistically significant predictor of the GEI. However, in models 2 and 3, controlling for transfer and academic characteristics, federal Pell grant status was no longer statistically significant. Nevertheless, the literature indicates that socioeconomic can predict the likelihood of graduation (Bowen et al., 2009; Doyle, 2010; Ellwood et al., 2000). The majority of students qualified for the federal Pell Grant, which may explain why the variable is not significant. Thus, more research is needed to truly determine the effect of the federal Pell grant and socioeconomic status.

Transfer and Academic Characteristics

Transfer and academic characteristics variables were entered into the stage 2 model that controlled for demographic and precollege academic characteristics. The variables included in the second model were: transfer student status, number of transfer institutions, number of major changes, earning a transfer associate degree, earning a WSU associate degree, if a student failed a course, if a student withdrew from a course, if a student repeated a course, if a student completed a remedial course, and the student's GPA at graduation. All the variables were statistically significant, except for if a student completed a remedial course.

This section will examine transfer and academic characteristics and its relationship to the GEI. The significant findings in this section are organized around four topics. The first topic is focused on how transferring institutions affects the predicted GEI. The second area will explore the findings related to earning an associate's degree and the negative effect on the predicted GEI. The third section will examine major changes and the GEI. The final section will review academic characteristics and the GEI.

Transfer and the GEI

Nearly 37.2% of all undergraduates across higher education have attended more than one institution (Shapiro, Dundar, Wakhumgu, Yuan, & Harrell, 2015). Many states and institutions have developed transfer articulation policies to facilitate efficient and effective transfer between institutions (Adelman, 2006; Anderson et al., 2006; Dougherty & Kienzl, 2006; Roksa & Keith, 2008). Effective transfer policies should increase the students ability to transfer, increase the transferability of credits and/or decrease credit loss (Roksa, 2009; Roksa & Keith, 2008).

A review of several statewide transfer articulation policies indicated that most policies are designed to reduce the amount of credit loss students experience when they transfer (Roksa & Keith, 2008). However, the acceptance of credit alone does not guarantee efficiency. The credit that is accepted must apply to students' degree requirements. Theoretically, if larger percentages of transfer credit apply to students' degree requirements, the more efficiently students should complete the bachelor's degree because the transfer credit applies to degree requirements rather than electives.

This study found that transfer students, the number of transfer institutions, and earning an associate's degree prior to transfer had a statistically significant negative effect on the GEI. That is, holding all other variables constant, transferring and completing an associate's degree prior to transfer resulted in less efficient pathways compared to students who did not transfer or complete an associate's degree prior to transfer.

For students who transfer from one institution, the regression model indicated the predicted GEI is 83.62%, holding all other variables constant; a student who did not transfer has a predicted GEI of 88.32%. Compared to a student who transferred from one institution, the difference is 4.7%, which is equal to 6 credits for a 120 credit hour program of study. The predicted GEI for students who trasnsfer from two institutions is 80.62%, a difference of 3% compared to students who transferred from one institution and a difference of 7.7% (9 credit hours) when compared to a student who did not transfer. For a student who transfers from three or more institutions the predicted GEI is 77.63%, a difference of 6% when compared to just one transfer institution and a

difference of 10.7% (13 credit hours) when compared to a student who did not transfer (see Figure 8 at the end of the chapter).

The difference in the predicted GEI may be due to the lack of applicability of credit, a well-documented phenomenon in the literature (Adelman, 2006; Anderson et al., 2006; Bender, 1990; Ott & Cooper, 2014; Roksa & Keith, 2008; Spicer & Armstrong, 1996). Furthermore, another explanation for the lack of applicability credit is a change in the student's degree pathway. The requirements of one degree pathway may be significantly different than another degree pathway. It is possible that some students successfully transferred credit from another institution but these credits did not meet any degree requirements. The disparity of credit loss is exacerbated when a student transfers from more than one institution.

Transfer articulation policies need to move beyond the general acceptance of credit and focus on the structure of transfer pathways. The strucuture of the transfer pathway is critical to reducing the nonpertinence of credit, because the pathway focuses on the applicability of credit towards the requirements for the bachelor's degree. Policies, such as California's Student Transfer Achievement Reform Act, can be developed that focus on the applicability of credit, not just the acceptance of credit, between institutions (Padilla, 2010). The formation of these policies needs to concentrate on the transferability of credit into specific programs of study. For example, what courses from a transfer institution would meet specific requirements in a chemistry degree at the receiving institution? In California, structured transfer pathways are gaining momentum and have shown to increase the number of students earning an associate's degree (Baker, 2016). An example in the state of Utah, the University of Utah (UofU) has developed transfer

pathways for students attending Salt Lake Community College (SLCC) in the form of getting ready guides, which inform what courses at SLCC will transfer into specific programs of study at the UofU (University of Utah, Office of Admissions, 2016).

Associate's degree attainment and the GEI

Research on the effects of earning an associate's degree is limited, but several studies have shown that earning an associate's degree may have a positive effect on a bachelor's degree (Belfield, 2013; Crook et al., 2012; Crosta & Kopko, 2014). However, little research addresses if earning an associate's degree increases or decreases degree efficiency.

The results of this study found that transferring with an associate's degree from another institution was a negative predictor of the GEI. Moreover, a student who earned an associate's degree from WSU also significantly decreased the predicted GEI. The results of the study are unprecedented. The current and historical rhetoric about transfer often encourages students to obtain an associate's degree before students transfer (Bender, 1990; Dougherty et al., 2006; Hungar & Lieberman, 2001; Knoell, 1990; Wellman, 2003). However, earning an associate's degree prior to transfer may not be in the best interest of the student if efficiency is the goal.

For students who earned an associate's degree before transferring, the predicted GEI was 79.11%, a difference of 9.2% (11 credit hours) when compared to the mean (a student who did not transfer and did not earn an associate degree) (see Figure 9 at the end of the chapter). The decrease is substantial and is a cause for concern. The inefficiency observed in this study may be due to the structure of the associate's degree. For example, students who pursue a general associate's degree are required to fulfill the institution's

general education requirements. At WSU, these general education requirements are 65% of the associate's degree (Weber State University Catalog, 2016). The standard associate's degree for the Utah System of Higher Education requires a minimum of 60 semester credit hours (Utah System of Higher Education, 2016). A significant portion of the degree is free electives (20 semester credit hours) and help fulfill the 60 credit hour requirement.

The free electives can be completed in any discipline. If the free electives are not directed towards a bachelor's degree or a student's program of study, the credit may not apply to students' bachelor's degrees. This same explanation may apply to WSU students who did not transfer but completed an associate's degree on the way to the bachelor's degree. If the WSU student does not direct the free electives of the associate's degree towards their bachelor's degree program, this would negatively influence the GEI. Nevertheless, if the free electives are directed towards a degree it is possible that student can complete an associate's degree more efficiently. In the state of Washington, students who participated in the associate of science transfer pathway program completed the associate's degree with fewer credits and with a higher transfer rate than other students (Kaikkonen, 2014)

Major changes and the GEI

Current research suggests that changing majors has little impact on graduation rates (Micceri, 2001; Murphy, 2000; Venit, 2016), and does not extend time to degree completion (Venit, 2016). However, the findings of this research indicate that students who change their major decreases the predicted GEI 1.5% for each major change. Assuming, the average student changes their major three time, the predicted GEI would

decrease by 4.5%, a difference of 5 credit hours for a major that requires 120 credit hours. The decrease in the GEI may be because the credits completed by a student required for one program of study may not apply to the newly declared program of study.

Remediation and the GEI

Remediation at the postsecondary level is costly (Pretlow, 2012), and many states question how remediation should be offered. Remedial courses are not allowed at public institutions in two states, and at least 5 states restrict remediation to two-year institutions (Bettinger & Long, 2009). Many students who enter college after high school are unprepared academically for college level material (Greene & Winters, 2005), and the standard practice has been to place underprepared students in remedial courses. Rationally, requiring students to take additional courses to prepare them for the academic rigor of college curriculum would seem to set a student back in regards to progress towards degree and efficiency.

However, some research suggests that remediation improves students' chances of persistence and degree attainment (Attewell et al., 2006; Bahr, 2008; Bettinger & Long, 2009; Lesik, 2006). Little research can be found regarding whether students who participate in remedial courses are more or less efficient when completing a degree. Findings in this study found that remediation was not a significant predictor of the GEI. Therefore, students who participate in remedial courses are not negatively affected regarding efficiency towards the degree. The findings of this study contribute to the some of the many positive outcomes of the remediation.

Nevertheless, it is difficult to speculate why remedial education does not have a significant effect on the GEI. One explanation is that the variable used for this study is

dichotomous and does not account for the intensity of remediation. On the other hand, WSU has a high percentage of students who participate in remediation (80%-85%) and in this sample only 21% of students participated in remediation. This sample does not account for all the students in remediation who may have dropped out. Furthermore, the sample may be biased towards students who were successful completers of remediation. However, another possible explanation is there are more programs developed and resources dedicated to meet the needs of students who are high-risk and disadvantaged (Jones & Perna, 2013; Kulik, Kulik, & Shwalb, 1983; Parsad & Lewis, 2003). The results of the programs may provide resources that increase efficiency. Overall, students who participate in remediation may be just as efficient as students who do not participate in remediation.

Academic achievement and the GEI

A student's success or failure in the classroom is a strong predictor of time to degree completion (Adelman, 2006; Jones-White et al., 2010; Knight, 2004; Knight & Arnold, 2000). This study also found that students' prior academic achievement is a strong predictor of the GEI. A failed course has a significant negative effect on a student's predicted GEI. For example, failing a course decreases students' GEI by 2.3% on average, which is about 3 credits. Moreover, this is compounded when a student chooses to repeat the failed course. A repeated course is expected to decrease the GEI by 4.8% (see Figure 10 at the end of the chapter).

The students who withdrew from a course did so some time after the third week of the beginning of the semester. The withdrawals are recorded on the student transcript and are accounted for in the total attempted credit hours but are not counted in the GPA

calculation. Withdrawal from a course will decrease the predicted GEI by 3.6%.

There are significant negative effects on the predicted GEI when a student withdraws from a course. Personal experience in the Office of the Registrar at WSU point toward a variety of reasons why students withdraw from courses. Often students experience some life event that prevents them from succeeding in the course such as increase work hours, medical emergencies, increased family responsibilities, or lack of financial support. Students who have these types of nonacademic issues are encouraged to withdraw if they cannot dedicate the time that is necessary to succeed in the course. Withdrawing gives the student an opportunity to salvage their GPA and reduces their workload to focus time on their life events and other courses. On the other hand, students will withdraw from a course if they are struggling academically. Before a student withdraws for academic reasons, they should speak with an academic advisor and are encouraged to take advantage of available recourses (i.e., tutoring) instead of withdrawing from challenging courses. Nonetheless, if a student is not academically prepared for the rigor of the course content then the student should withdraw, after consultation with an academic advisor, and take other courses that will prepare them for the academic rigor.

Withdrawing or failing a course that is required for the program of study will require a student to repeat the course to meet the requirements. In addition to withdrawing or failing a course, repeating a course has negative 4.8% on the GEI. Therefore, students will be more inefficient if they are repeating failed or withdrawn courses.

Curriculum Structure

The curriculum structure, or the percent of free electives in the program of study, has a small but statistically significant impact on the predicted GEI. The results indicate that for every one percent increase in free electives, the predicted GEI also increases by 0.8%, or less than one tenth of one percent. In similar research, Gillmore and Hoffman (1997) suggest that the type of degree, a BS or BA, impacted graduation efficiency. They found students who graduated with a BA had a higher GEI than students who graduated with a BS degree. However, their research did not identify the structural differences between the BS and BA.

Figure 11 highlights an example of the mean and the predicted GEI of the percentage of free electives in a program of study. The average student in a major which 30% (approximately 36 semester credit hours) of the program of study are free electives has a more efficient predicted GEI (90.03%) than a program of study with no free electives (87.42%), a difference of 2.61%.

Programs of study with more free electives in the major allow students to explore a variety of courses without sacrificing efficiency. Programs of study that have no free electives do not allow students to explore, and students often take only the prescribed courses. Furthermore, students who change their major to a program of study with little or no free electives will have courses that are not applicable to the new program requirements. On the other hand, students who change to a program of study with many free electives, the courses that do not meet program requirements can be absorb by the free electives. Arguably, programs of study which have more free electives in the curriculum are more likely to absorb credits that may not apply to degree requirements.

However, the effect is small and the difference between programs of study with 30% free electives versus programs of study with 0% free elective is approximately one course (3 credit hours). It is unknown why the effect is small and may have to do more with the behavior of the students rather than the structure of the curriculum.

Policy Problem-Structuring

"Policy problems are unrealized needs, values, or opportunities for improvement. Information about the nature, scope, and severity of a problem is produced by applying the policy-analytic procedure of problem structuring" (Dunn, 2012, p. 67). Policy problems are not independent entities, but rather exist as parts of whole systems of problems. Dunn (2012) describes a whole system of problems as messes, that is, "systems of external conditions that produce dissatisfaction among different segments of the community" (Dunn, 2012, p. 69). System of problems need to be viewed from a holistic approach, one which views problems as interconnected.

Problems are partly subjective constructs. The external conditions define, classify, and evaluate what are problems. Policy problems are subjective because the subjectivity is based on who is defining the problem and how they are assessing the environment. Therefore, policy problems are products of subjective human judgement. "Problems have no existence apart from the individuals and groups who define them, which means that there are not 'natural' states of society that in and of themselves constitute policy problems" (Dunn, 2012, p. 70). Policy problems are in a constant flux. There are as many solutions to problems as there are definitions of the problem.

The initial problems identified in this study were: (a) students graduate with more credits than needed to complete their degree; and (b) unclear information about what

contributes to degree efficiency. Many factors were studied to determine what factors had a statically significant influence on degree efficiency. The results of this study affirmed that age at graduation, nonresident (US), dual enrollment, transfer, number of transfer institutions, number of major changes, attaining an associate's degree, failing a course, withdrawing from a course, repeating a course, and the curriculum structure had a statistically significant influence on the GEI.

The information generated from this study can be used to structure policy problems. The exercise of structuring policy problems is demonstrated with two examples. The first example is a scenario, which the faculty at WSU are interested in increasing degree efficiency by cutting back on the number of general education requirements. The second example is structuring a policy to help students transfer more efficiently.

Example 1

In this example, the faculty have sensed that students are not graduating efficiently and they have determined that the problem may be because of the amount of credits required for general education. For bachelor's degrees, the general education requirement is 41 credit hours. The faculty have determined many of the essential learning outcomes are unnecessarily repeated among several of the requirements. The faculty found that there is an opportunity to streamline the general education requirements and conceptualized that by doing so would increase degree efficiency. Therefore, faculty have purposed to cut 10 credits from the general education requirements, reducing the total from 41 to 31 credit hours.

In this example, the faculty have sensed a problem with degree efficiency. They

have determined the problem situation is the amount of general education requirements. The next step is to determine if cutting general education will increase degree efficiency. The 10 credits reduced in general education requirements would allow for an increase of 10 credits of free electives for many bachelor's programs of study, assuming that departments do not increase their major requirements to fill the void of the cut general education credits.

This study has found for the average student, while controlling for demographics, precollege characteristics, transfer and academic characteristics, every 1% increase of free electives in the program of study, the GEI increases by 0.8%. Therefore, if faculty decreased the general education requirements by 10 credits, which would increase the free electives in the program of study by 8%, for a 120 credit hour degree, the average student's GEI will increase by 0.64%. Thus we see, cutting the general education requirements has a small effect on the GEI. The faculty would have to determine if the 0.64% gain in efficiency is enough justification to cut the general education requirements.

This example illustrates that empirical understanding of the problem situation can better inform the faculty on how to structure and define the problem. The problem may not be that number of credits required for general education affects degree efficiency. The critical issue of problem structuring is how well the problem is understood, defined and actually corresponds to the original problem.

Example 2

In the second example, administrators are seeking to increase degree efficiency for students who transfer within the state. The administrators suspect that transfer students are graduating with too many credits when they graduate with their bachelor's

degree. They want to develop a policy that will increase degree efficiency for transfer students.

Structuring or defining the policy problem is very complex. Nevertheless, it is imperative to understand the problem situations that may contribute to structuring the problem. In this example, the desired outcome is to increase degree efficiency for transfer students. Therefore, variables must be examined to determine which variables have a positive or negative affect on degree efficiency. This study has identified a number of variables that affect the GEI. Specific variables that directly affect transfer students (while controlling for demographics, precollege characteristics, academic characteristics and curriculum structure) are transfer, number of transfer institutions, and transfer associate's degree attainment, which, to a varying degree, have a significant negative affect on the GEI.

Some of the variables need to be studied further to gain a more complex understanding of the problem. For instance, the number of transfer institutions can negatively affect degree efficiency. However, the data from this study do not specify why students are transferring from multiple institutions and furthermore, do not assess the articulation policies from one institution to another before all the credits are transferred to the final institution. Nevertheless, the end outcome is that students who transfer from multiple institutions are less efficient than those who do not. Those who are structuring the problem should be aware of complexities of the issues and seek further understanding on variables that are less understood.

The administrators in this example recognize that the state has well developed articulation policies and have focused their attention on associate's degree attainment

before transferring. They are concerned that transferring an associate's degree has a negative effect on the GEI. They have postulated that the possible cause for the negative affect of earning an associate's degree has to do with poor use of free electives and the performance-funding model based on awarding institutions for the number of associate's degrees earned. Therefore, the administrators propose a solution to address the problem they have structured. Their solutions focuses on the utilization of guided pathways between state institutions and establishing a business practice for reverse transfer. Furthermore, they suggest to the state legislatures to adjust the performance-funding model to award transferring in lieu of earning an associate's degree.

Guided pathways is a program that works with both the receiving institution and the sending institution (Bailey, Jaggars, & Jenkins, 2015; Baker, 2016; Jenkins & Cho, 2013). The guided pathway articulates what courses a student should take while attending their first institution that will transfer and be applicable to a specific program of study at the receiving institution. In theory, the guided pathway would ensure the student is using their elective credit effectively. However, some programs of study at the receiving institution are limited on what is applicable to their degree from the sending institution. Thus, the student is limited to course options at the sending institution and should transfer to the receiving institution to pursue the applicable courses. Often this means the student should transfer before earning a credential at the sending institution. Reverse transfer allows for the student to transfer before earning an associate's degree and pursue the courses at the receiving institution, then transfer the credits earned at the receiving institution back to the sending institution to fulfill the remaining requirements for the associate's degree (Taylor, 2016). Once the associate's degree is earned and recorded on

the student's academic transcript, the associate's degree can be transferred to the receiving institution. Reverse transfer may allow a student to remain efficient through the transfer process. Nevertheless, with both programs the student must be forward thinking and know what program of student they want to pursue at the receiving institution. This will require the development and advancement of strong advising systems to support students and ensure they make progress toward their degree along their pathways.

The solutions to the problem would then have to be studied to determine their efficacy. Problem-structuring is open, fluid and subjective. Therefore, it is important to develop policy-relevant information, to investigate policy-related questions. Policy analytic methods are then used to evaluate policy-relevant information.

Recommendations for Further Research

The discussion above highlights several important implications for the field of higher education that are discussed in this section and the next section. The first section discusses four areas in which further research is warranted: (1) transcript analysis exploring the applicability of credit earned when a student transfers, earns an associate degree, and changes majors (2) adding variables to the exploration of efficiency at graduation, (3) testing this study's findings across multiple institutional types, and (4) testing this study's findings across various fields of study.

Further research is needed to examine student transcript data that explores what credit applies to a program of study and what credit does for transfer students, students who attain associate degrees, and students who change majors. Although, the findings of this study identify variables that have a negative effect on the predicted GEI, this study is unable to identify why there is excess credit or what credits do not apply to the degree.

The detail of analysis at the transcript level will provide insights on the academic pathway and how to serve students better. For example, when a student changes majors, what majors are the most compatible in terms of similar applicability of credit? Are there common courses that meet requirements for several majors? Furthermore, the analysis will provide insight on the effectiveness of transfer articulation policies. How much of the course work transferred is equivalent to courses taught at the institution? How much credit that is transferred as elective credit applies to degree requirements?

The regression model only explained 30% of the variance, which suggests an ommitted variable bias and additional variables could strengthen the model. These additional variables could include, marital status, whether students commute to campus or live in campus housing, scholarship status, credits for specific programs of study to explore whether the variable influences the predicted GEI. Other variables that should be included in future research are measures of the intensity of participation in dual enrollment programs. Similarly, variables such as the number of courses that students fail, withdraw, and repeat should be included in future analysis. Furthermore, variables that measure socioeconomic status or poverty level founded in parental income should be included in future research. Finally, future research should include variables such as employment or participation in activities outside the academic environment.

The third area for future research is whether the findings presented in the study are consistent across various institutions. This study explored one public, four-year master's institution and future research should replicate this study in different institutional types because results of this study may be significantly different from a private institution or a large research institution. Different types of institutions enroll

different types of students and are structured differently both in curriculum and services. The study should compare different types of institutions to determine if the problem-situations remain significant.

This study explored curriculum structure but did not consider specific fields of study. For example, how do chemistry fields of study differ from mathematics fields of study in predicting the GEI? The study of various fields of study can identify whether there are problems related to course sequencing in the field of study. The curriculum structure examined in this study focused on the amount of free electives in the program of study. Different programs of study have varied requirements and the sequencing of courses that may present challenges to efficiency. For example, a program of study might have several sequences of prerequisites that a student must follow to maintain progress. However, if the student is out of sequence with the offering of the prerequisites the student may enroll in classes that are not needed.

Implications for Policy and Practice

In addition to informing an agenda for future research, this study also has implications for policy and practice. The findings in this study have highlighted variables that represent problem-situations related to graduation efficiency. The next step in the policy analysis method is to develop a policy that addresses the previously structured problem (Dunn, 2012). The three primary implications for policy and practice include: (1) institutional policy and practice; (2) efficiency metrics; and (3) state higher education policy.

Institutional policy and practice

The findings from this study revealed the academic pathway is complex and many variables can affect a student's degree efficiency. This study did not reveal how institutions should address policy problems related to degree efficiency, but rather, developed reliable information that revealed what variables contribute to degree efficiency, that then can be used to structure policy problems and solutions. Furthermore, students can benefit from the findings of this study through participation in dual enrollment programs, development of more robust transfer articulation policies, guided pathways to the bachelor's degree, and policy designed to maximize the efficiency of how the curriculum is structured.

This study revealed that students who participated in dual enrollment programs maintained a higher predicted GEI. Students should be encouraged to participate in these types of programs. However, careful guidance should be given to students to ensure they are taking a class that applies to future degree requirements. Institutions should develop pathways between the dual enrollment programs and programs of study. These pathways should inform the student how their dual enrollment credit applies to various programs of study. For example, a student who successfully passes a dual enrollment course should know how the credit will be awarded at the institution and how the credit will be applied to various programs of study.

Students can benefit from more robust transfer articulation policies. Many transfer articulation policies are designed simply to facilitate the equivalence of courses between two institutions. However, these policies need to move beyond the articulation of the course and articulate how the course may be applied toward degree requirements and

align with degree pathways.

A state policy example is the Tennessee Transfer Pathway program that was developed to move beyond the articulation of course to the articulation of how courses will apply to degree requirements. The Tennessee Transfer Pathway outlines courses a student needs to complete to maximize their transfer credit in specific programs of study and with the added benefit of completing an associate's degree from the community college. Students take major courses at the two-year institution within each program of study and these courses are articulated and applied toward their baccalaureate degree program after transfer. Furthermore, whenever the student transfers to a Tennessee public or private institution, the transcript will certify that the pathway has been followed (Tennessee Transfer Pathway, 2017).

Nevertheless, the guided pathway, how the credit will apply to a program of study, needs to move beyond static graduation maps and address the complexities of the academic pathway. The guided pathway should also be incorporated into transfer articulation policies and develop pathways between institutions. The guided pathways should be specific to programs of study and highlight the opportune time to transfer to maximize efficiency.

Students can also benefit from curriculum policies designed to maximize efficiency. Programs of study that have no free electives built into the curriculum are challenging for students to complete efficiently and do not allow for exploration. Consequently, students who pursue programs of study with no free electives have little room for exploration. Curriculum policy needs to be designed to ensure the required content is delivered while allowing for academic exploration.

Repeating, withdrawing or failing a course were some of the largest coefficients that negatively affected the GEI. These types of academic transactions are an indication of a student's ability to be successful in the classroom. Student who are struggling in the classroom need to be identified with early interventions. Often the professor is the most suited to identify a struggling student. Nevertheless, a support team of the advisor and student services needs to help recognize available resources that the student can take advantage of to increase the probability of success. A communication system between the professor and the intervention team needs to be developed that will ensure a timely response.

Efficiency metrics

The findings of this study also inform administrators of better measures of efficiency that focus on the use of resources rather than relying on comparisons of like colleges or universities. The GEI gives administrators an analytical tool to examine how students at their institution compared to other students within the same institution, in the same programs and using the same resources. GEI complements the time to degree metric because it measures how well the student is using the resources. The GEI measures the student's efficient use of resources in terms of how efficiently the credits a student completes apply towards the degree requirements. Therefore, in conjunction with time to degree the GEI measures the efficient use of resources during that time. For example, a student may have taken longer to complete a degree because they are taking fewer credits per semester, but is 100% efficient. Many students cannot attend school full-time, so labeling students as inefficient or institutions as inefficient because of their part-time students is not accurate. Furthermore, the findings also help administrators identify

problems specific to their students that can be addressed and measured.

State higher education policy

The final policy recommendation is focused on state and higher education policy. In addition to the initiatives discussed above, the higher education policy can benefit from two primary recommendations: efficiency measures founded in the use of resources and the value placed on associate's degree attainment pretransfer or on the way to a bachelor's degree.

Each institution in the United States is constructed differently and attracts different students. Efficiency measures designed to compare similar institutions may be measuring successes of student characteristics rather than institutional characteristics. For example, policy that is focused on time to degree completion may be comparing the characteristics of students rather than the institution. The students who attend WSU are often older and have many responsibilities, such as work and family, in addition to their school responsibilities. Students at WSU often attend part-time to balance successfully all their responsibilities. Consequently, when WSU is compared to other institutions on the metric of time to degree, it shows that WSU students take longer to complete their degree. In this case, the measure is more revealing of the characteristics of students who attend WSU rather the characteristics of the institution. Therefore, efficiency measures should be designed to parse out the student characteristics from the institutional characteristics. An institution that enrolls a large portion of students who attend part-time may be unfairly compared to an institution that enrolls a traditional student. The measure of efficiency should be founded in the students' efficient use of the resources. The GEI is therefore a better metric because it can parse out the student's characteristics from the

institutional characteristics.

The findings of this study astonishingly indicated that earning an associate's degree pretransfer might not be in the best interest of students who transfer because their predicted GEI is lower than students who do not complete the associate's prior to transfer. Moreover, students who earn an associate's degree at WSU also have a significantly lower predicted GEI relative to those students that do not.

One measure of community college success is the number of students they graduate. Many of the students at the community college intend to transfer to another institution to complete their bachelor's degree (Adelman, 2006; Levin & Kater, 2012; Pascarella et al., 2005). Community colleges often encourage students to complete an associate's degree before transferring. This study reveals that completing an associate's degree results in significant negative consequences as measured by the GEI. In addition to the number of associate's degrees awarded, community colleges should be measured based on the number of students who choose to transfer to bachelor degree programs.

There is room for more research on the earning an associate's degree and graduation efficiency. The findings in this study indicate that the associate's degree causes students to be less efficient. However, an associate's degree may be a valuable asset to encourage persistence and degree completion (Belfield, 2013; Crook et al., 2012; Crosta & Kopko, 2014). Yet, students whose goals is complete a bachelor's degree an associate's degree may use up valuable time and resources and ultimately delay graduation. The findings of this study should be considered when developing incentive programs and funding models.

These results have implications for state performance-funding programs founded

in graduation rates and the transfer mission of community colleges. Performance funding programs may use different incentive models to increase the productivity of the institutions. One common productivity measurement in the incentive model is the number of students who complete a degree. Therefore, funding incentives may encourage institutions that offer associate's degrees to engage in a behavior to boost the associate's degree completion rate for students who are completing the bachelor's degree. Although this behavior might support state degree attainment goals, results from this study show an unintended negative consequence of completing associate's degrees: a decrease in the GEI or efficiency of students' pathway. This is contrary to the fiduciary intent of the performance funding policy.

Adding value to the number of successful transfers could incentivize community colleges to advise towards the most opportune time to transfer rather than advising towards completing the associate's degree. Students should transfer when they have completed all courses that can apply to the bachelor's program of study. Transferring focused on bachelor degree requirements rather than on the completion of the associate's degree will eventually save the student time and money because they will not complete unnecessary courses to meet the requirements for the associate's degree. In some cases, earning an associate's degree may be appropriate. However, in other cases, the student may need to transfer earlier. Reverse transfer programs can also be developed to meet the demands of both institutions (Taylor, 2016). The development of transfer pathways, as what Tennessee has developed, can help save time and money.

Conclusion

This study used the GEI to measure the impact of several variables that were sensed to be problem situations. The results of the study indicate there are several problem situations that contribute to degree efficiency. These problem situations related to demographic and precollege academic characteristics, transfer and academic characteristics, and curriculum structure can then be used to structure an overall policy problem.

Demographic and precollege academic characteristics indicate that age at graduation, nonresident (US), and dual enrollment programs affect degree efficiency. Among the demographic and precollege academic characteristics, only dual enrollment has a positive effect on degree efficiency. Conversely, students who are nonresidents (US) and the older the student is at graduation the less efficient they become.

Transfer and academic characteristics indicated that transfer students, number of transfer institutions, number of major changes, transfer associate's degree, WSU associate's degree, failing a course, withdrawing from a course, and repeating course, all had a negative effect on degree efficiency. However, the GPA at graduation had a positive effect on graduation and had the largest impact on the predicted GEI for a single variable. Nevertheless, a student who transfers with an associate's degree had a significant negative impact on the predicted GEI.

Curriculum structure investigated what impact the percentage of free electives in a program of study has on the predicted GEI. Free electives had a positive effect on the GEI. However, the efficacy is low and requires a substantial portion of the program of study, such as 25%, to have a meaningful effect on the GEI.

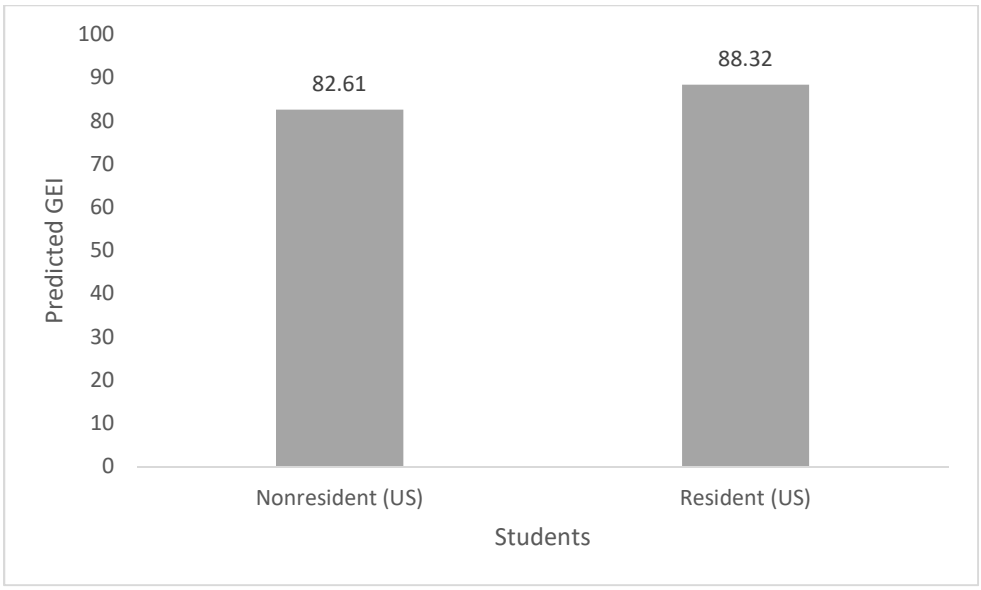

Figure 5 Comparison of predicted GEI of student who is a nonresident (US) versus a resident (US).

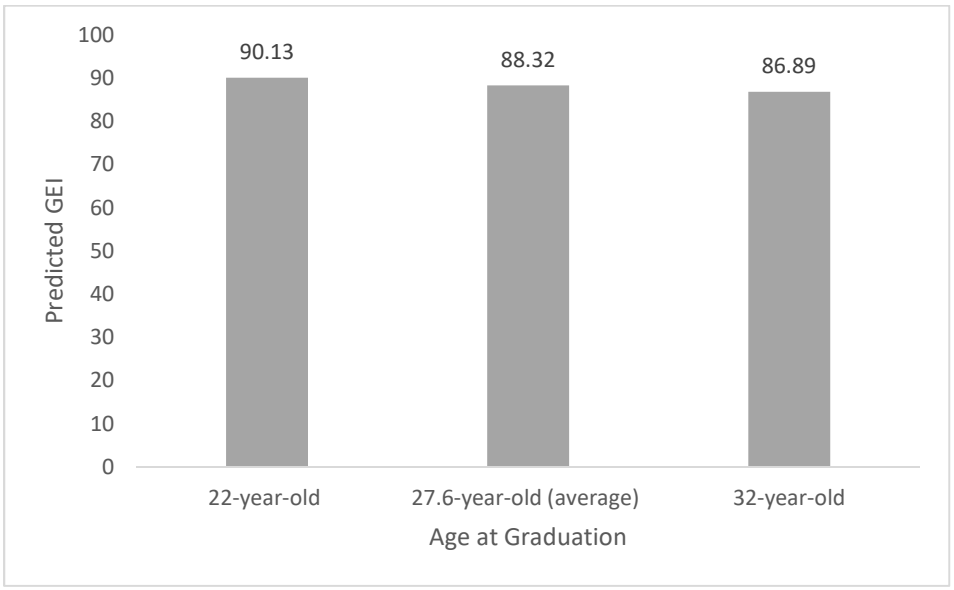

Figure 6 Comparison of predicted GEI of a 22-year-old student versus the average student in the sample versus a 32-year-old student.

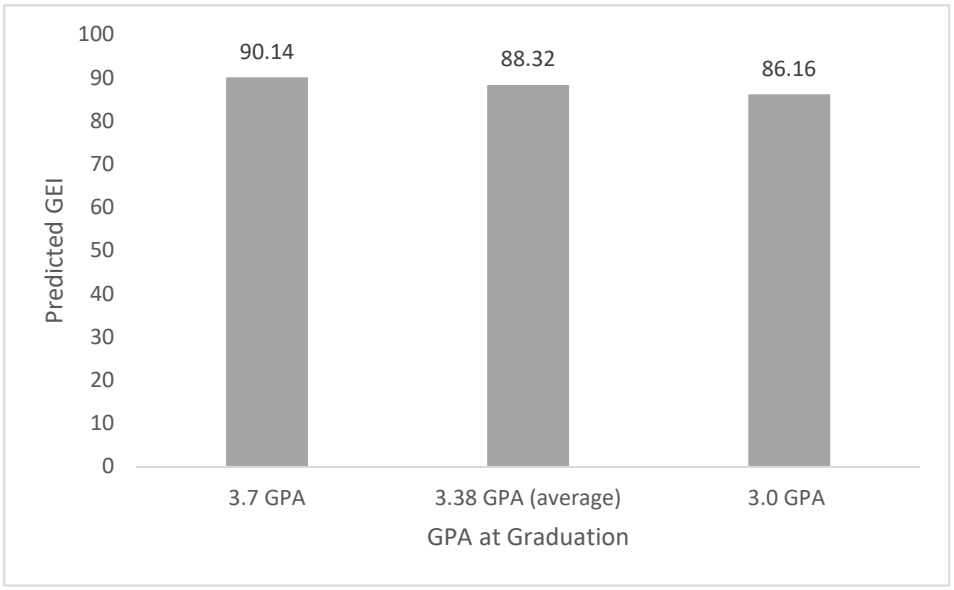

Figure 7 Comparison of predicted GEI when student has a 3.7 GPA and student has a 3.0 GPA.

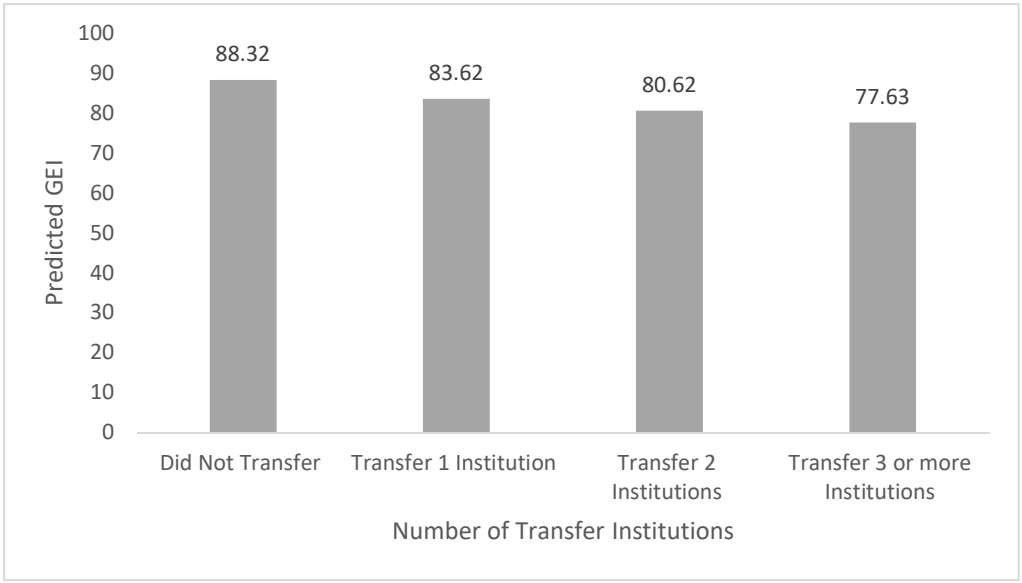

Figure 8 Comparison of predicted GEIs based on the number of transfer institutions.

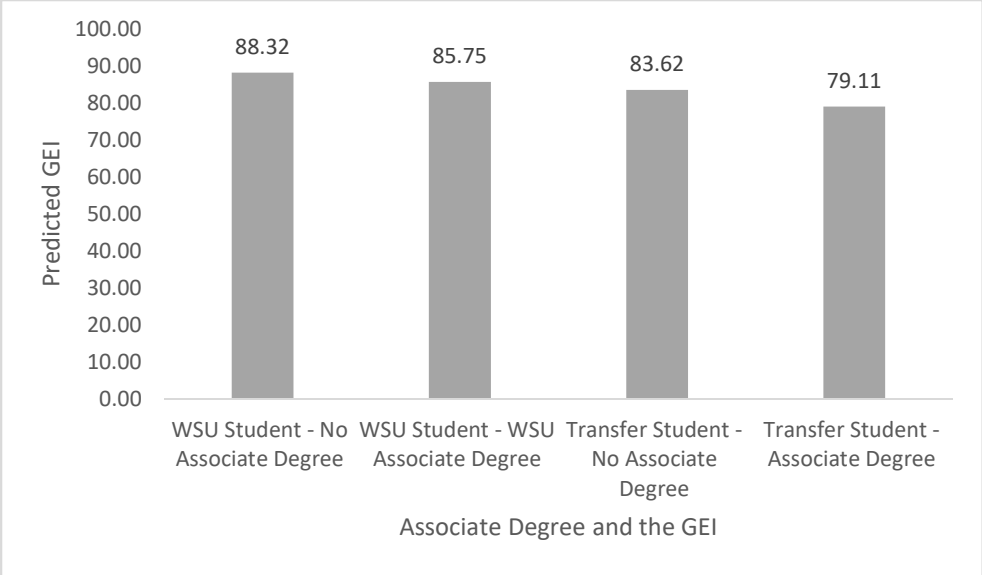

Figure 9 Comparing predicted GEI of students who earned an associate degree.

Figure 10 Comparison of the predicted GEI and enrollment transactions.

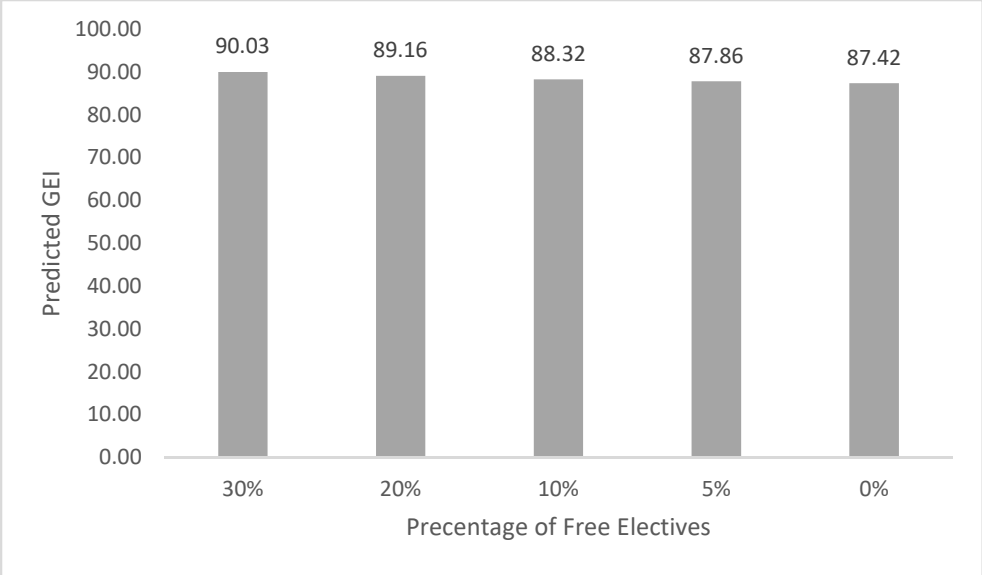

Figure 11 Percentage of free electives in a program of study compared to the mean.

APPENDIX A

ASSUMPTIONS

Normality

To test for normality, a histogram of GEI was run, as seen in Figure 12, the regression standard residuals are normally distributed.

Multicollinearity

To check for multicollinearity, a variance inflation factor (VIF) and tolerance tests were conducted, as shown in Table 7 Variance inflation factor test and tolerance. This table details the VIF and tolerance for multicollinearity.

If the largest VIF is greater than 10 then there is cause for concern (Bowerman & O'Connell, 1990; Myers, 1990). Additionally, if the average VIF is substantially greater than 1 then the regression may be biased (Bowerman & O'Connell, 1990). Tolerance below 0.2 indicates a potential problem (Menard, 1995).

Transfer students and number of transfer institution is close to the tolerance levels, which may cause concern. However, the VIF score is below ten and the decision was made to continue with both variables.

Homoscedasticity

The assumptions of homoscedasticity were checked using a plot of the regression standardized residuals and the regression standardized predicted value. The plot of the values is found in Figure 13. The majority of the clustering is in the center indicating assumptions of linearity and homoscedasticity have been met. The data do have a minimum threshold related to the bachelor's degree, as can be seen to the top right quadrant of the scatterplot. All bachelor's degrees require a minimum of 120 credit hours.

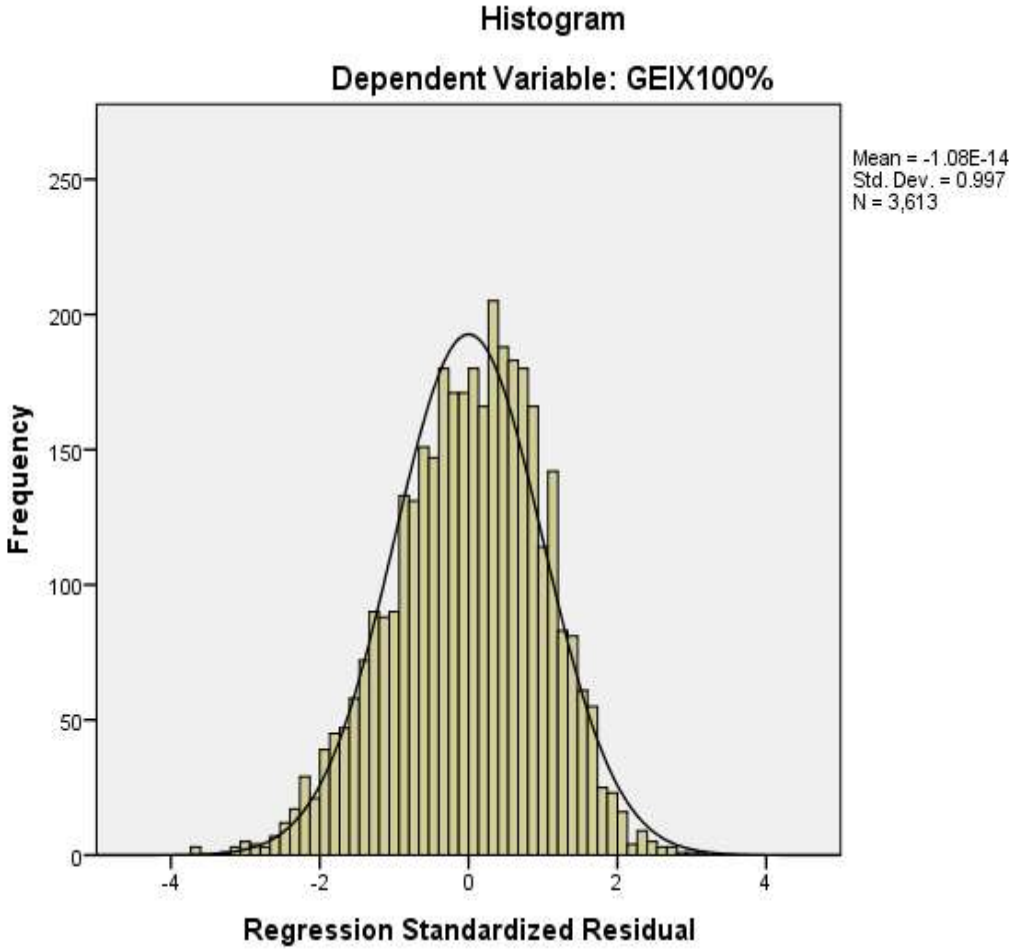

Figure 12. Histogram of the GEI. The figure demonstrates the distribution of GEI for all students.

Table 7 *Variance inflation factor test and tolerance. This table details the VIF and tolerance for multicollinearity.*

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Gender	0.950	1.052
	Age at Graduation	0.768	1.302
	Hispanic	0.980	1.020
	Nonresident	0.861	1.162
	Unknown	0.981	1.019
	Other	0.980	1.020
	Dual Enrollment Programs	0.737	1.357
	Entry GPA	0.786	1.272
	Federal Grant	0.931	1.074
2	(Constant)		
	Gender	0.895	1.117
	Age at Graduation	0.720	1.388
	Hispanic	0.976	1.025
	Nonresident	0.785	1.273
	Unknown	0.972	1.029
	Other	0.968	1.033
	Dual Enrollment Programs	0.616	1.623
	Entry GPA	0.605	1.652
	Federal Grant	0.908	1.102
	Transfer Student	0.184	5.432
	Number of Transfer Institutions	0.218	4.593
	Number of Major Changes	0.620	1.613
	Transfer Associate Degree	0.625	1.600
	WSU Associate Degree	0.793	1.262
	Failed a Course	0.531	1.884
	Withdrew From a Course	0.815	1.227
	Remedial Course	0.783	1.278
	Repeated a Course	0.567	1.764
	GPA at Graduation	0.505	1.979
3	(Constant)		
	Gender	0.860	1.162
	Age at Graduation	0.715	1.398
	Hispanic	0.975	1.025
	Nonresident	0.779	1.284
	Unknown	0.969	1.032
	Other	0.968	1.033
	Dual Enrollment Programs	0.615	1.627
	Entry GPA	0.603	1.658
	Federal Grant	0.908	1.102
	Transfer Student	0.184	5.432
	Number of Transfer Institutions	0.218	4.593
	Number of Major Changes	0.620	1.613
	Transfer Associate Degree	0.623	1.606
	WSU Associate Degree	0.787	1.270
	Failed a Course	0.530	1.885
	Withdrew From a Course	0.815	1.227
	Remedial Course	0.783	1.278
	Repeated a Course	0.566	1.767
	GPA at Graduation	0.505	1.981
	Percentage of Free Electives	0.918	1.089

a. Dependent Variable: GEIX100%

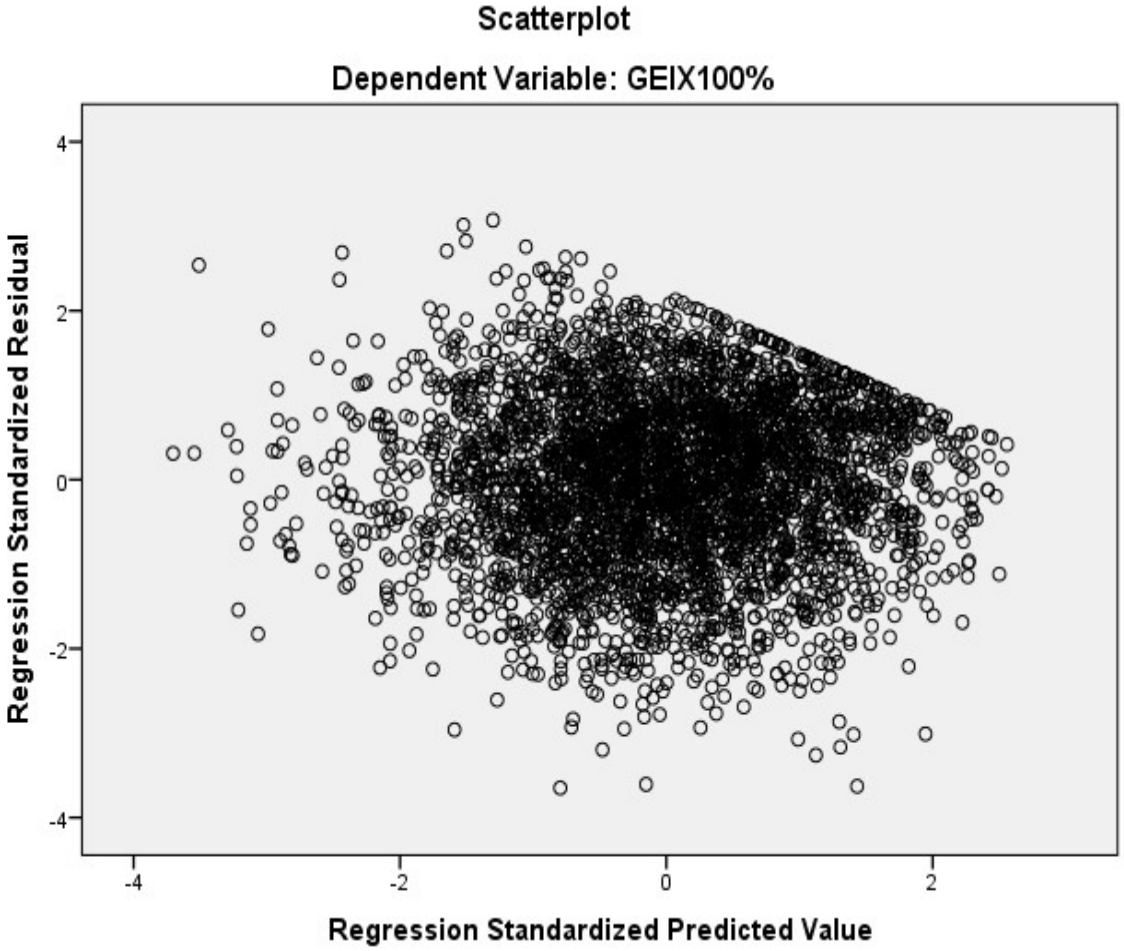

Figure 13 Scatterplot of standardized residuals and standardized predicted values.

APPENDIX B

FULL MODEL RESULTS

Table 8
Model 1 Demographic and precollege academic characteristics.

	Model 1		
	Unstandardized Coefficients	*Standardized* Coefficients	
	B	SE	*β*
(Constant)	78.066	1.854	
Gender	0.965*	0.407	0.039
Age at Graduation	-0.356***	0.034	-0.189
Hispanic	-0.505	0.819	-0.010
Nonresident	-3.917**	1.181	-0.053
Unknown	-0.617	.0748	-0.013
Other	-1.430	0.887	-0.026
Dual Enrollment Programs	2.519***	0.485	0.095
Entry GPA	2.686***	0.415	0.115
Federal Grant	-1.211**	0.421	-0.47
R2	0.106		
F	47.500		
Δ*R2*			

Note: *$p < .05$; **$p < .01$; ***$p < .001$

Table 9
Model 1 Demographic and precollege academic characteristics with Hispanic removed.

	Model 1		
	Unstandardized Coefficients		Standardized Coefficients
	B	*SE*	*β*
(Constant)	77.959	1.846	
Gender	0.961*	0.408	0.038
Age at Graduation	-0.355***	0.034	-0.189
Nonresident	-3.872**	1.186	-0.055
Unknown	-0.580	0.746	-0.012
Other	-1.391	0.884	-0.025
Dual Enrollment Programs	2.495***	0.486	0.094
Entry GPA	2.653***	0.416	0.113
Federal Grant	-1.241**	0.421	-0.48
R2	0.106		
F	53.399		
Δ*R2*			

Note: *$p < .05$; **$p < .01$; ***$p < .001$

Table 10

Model 1 Demographic and precollege academic characteristics Hispanic and Unknown removed.

	Model 1		
	Unstandardized Coefficients		Standardized Coefficients
	B	*SE*	*β*
(Constant)	77.688	1.839	
Gender	0.981*	0.407	0.039
Age at Graduation	-0.355***	0.034	-0.189
Nonresident	-3.701**	1.181	-0.053
Dual Enrollment Programs	2.519***	0.485	0.095
Entry GPA	2.686***	0.415	0.115
Federal Grant	-1.211**	0.421	-0.47
R2	.105		
F	70.695		
Δ*R2*			

Note: **p* < .05; ***p* < .01; ****p* < .001

Table 11
Model 2 Transfer and academic characteristics.

	Model 1			Model 2		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	*SE*	*β*	B	SE	*β*
(Constant)	77.688	1.839		83.141	2.475	
Gender	0.981*	0.407	0.039	-0.074	0.367	-.003
Age at Graduation	-0.355***	0.034	-0.189	-0.331***	0.030	-0.177
Nonresident	-3.701**	1.181	-.053	-5.176***	1.083	-0.074
Dual Enrollment Programs	2.519***	0.485	0.095	1.490**	0.465	0.056
Entry GPA	2.686***	0.415	0.115	-0.630	0.415	-0.027
Federal Grant	-1.211**	0.421	-0.47	-0.604	0.373	-0.023
Transfer Student				-1.872*	0.839	-0.072
Number of Transfer Institutions				-2.972***	0.381	-0.230
Number of Major Changes				-1.516***	0.144	-0.184
Transfer Associate's degree				-4.407***	0.504	-0.152
WSU Associate's degree				-2.402***	0.406	-0.091
Failed a Course				-2.189***	0.505	-0.082
Withdrew From a Course				-3.573***	0.399	-0.137
Remedial Course				-0.668	0.484	-0.021
Repeated a Course				-4.783***	0.461	-0.190
GPA at Graduation				5.781***	0.664	0.168
R2	0.105			0.317		
F	70.695			111.569		
Δ*R2*				0.212		

***Note**: *p < .05; **p < .01; ***p < .001*

Table 12
Model 2 Transfer and academic characteristics with remedial removed

	Model 1			**Model 2**		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	*SE*	*β*	B	SE	*β*
(Constant)	77.688	1.839		82.753	2.460	
Gender	0.981*	0.407	0.039	-.092	0.367	-.004
Age at Graduation	-0.355***	0.034	-0.189	-0.334***	0.030	-0.178
Nonresident	-3.701**	1.181	-.053	-5.179***	1.083	-0.074
Dual Enrollment Programs	2.519***	0.485	0.095	1.572**	0.461	0.059
Entry GPA	2.686***	0.415	0.115	-0.557	0.412	-0.024
Federal Grant	-1.211**	0.421	-0.47	-0.626	0.373	-0.024
Transfer Student				-1.706*	0.831	-0.065
Number of Transfer Institutions				-2.979***	0.381	-0.231
Number of Major Changes				-1.521***	0.144	-0.184
Transfer Associate's degree				-4.356***	0.503	-0.084
WSU Associate's degree				-2.394***	0.406	-0.091
Failed a Course				-2.240***	0.503	-0.084
Withdrew From a Course				-3.603***	0.398	-0.138
Repeated a Course				-4.833***	0.460	-.192
GPA at Graduation				5.799***	0.664	.168
R^2	0.105			0.317		
F	70.695			123.722		
ΔR^2				0.212		

***Note**: *p < .05; **p < .01; ***p < .001*

Table 13
Model 3 Final model curriculum structure

	Model 1			Model 2			Model 3		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	*SE*	*β*	B	SE	*β*	B	SE	*β*
(Constant)	77.688	1.839		82.753	2.460		81.697	2.459	
Gender	0.981*	0.407	0.039	-.092	0.367	-.004	-0.477	0.373	-0.019
Age at Graduation	-0.355***	0.034	-0.189	-0.334***	0.030	-0.178	-0.323***	0.030	-0.171
Nonresident	-3.701**	1.181	-.053	-5.179***	1.083	-0.074	-5.709***	1.084	-0.082
Dual Enrollment Programs	2.519***	0.485	0.095	1.572**	0.461	0.059	1.682***	0.460	0.064
Entry GPA	2.686***	0.415	0.115	-0.557	0.412	-0.024	-0.420	0.411	-0.018
Federal Grant	-1.211**	0.421	-0.47	-0.626	0.373	-0.024	-0.624	0.371	-0.024
Transfer Student				-1.706*	0.831	-0.065	-1.712*	0.828	-0.066
Number of Transfer Institutions				-2.979***	0.381	-0.231	-2.992***	0.379	-0.232
Number of Major Changes				-1.521***	0.144	-0.184	-1.528***	0.144	-0.185
Transfer Associate's degree				-4.356***	0.503	-0.084	-4.507***	0.502	-0.156
WSU Associate's degree				-2.394***	0.406	-0.091	-2.566***	0.406	-0.098
Failed a Course				-2.240***	0.503	-0.084	-2.322***	0.502	-0.087
Withdrew From a Course				-3.603***	0.398	-0.138	-3.579***	0.397	-0.137
Repeated a Course				-4.833***	0.460	-.192	-4.755***	0.458	-0.189
GPA at Graduation				5.799***	0.664	.168	5.688***	0.662	0.165
Percentage of Free Electives							0.087***	0.017	0.074
R2	0.105			0.317			0.319		
F	70.695			123.722			27.066		
Δ*R2*				0.212			0.005		

***Note**: *p* < .05; ***p* < .01*;* ***p < .001

APPENDIX C

UPPER AND LOWER BOUND PREDICTIONS

Table 14
Upper and lower bound predictions.

	Age at Graduation	Nonresident	Dual Enrollment Programs	Transfer Student	Number of Transfer Institutions	Number of Major Changes	Transfer Associate Degree	WSU Associate Degree	Failed a Course	Withdrew From a Course	Repeated a Course	GPA at Graduation	Percentage of Free Electives	Point Prediction	t-value	Approx St. Error of Pred	Margin of Error	Lower Bound	Upper Bound	Interval width	120 POS
Nonresident Alien	27.6	1	0	0	0	3	0	0	0	0	0	3.38	10.3	82.61	1.961	11.436	22.421	60.190	105.032	44.842	20.87
Resident	27.6	0	0	0	0	3	0	0	0	0	0	3.38	10.3	88.32	1.961	11.436	22.421	65.899	110.741	44.842	14.02
22-year old	22	0	0	0	0	3	0	0	0	0	0	3.38	10.3	90.13	1.961	11.436	22.421	67.707	112.550	44.842	11.85
28 - year-old	35	0	0	0	0	3	0	0	0	0	0	3.38	10.3	86.90	1.961	11.436	22.421	65.769	110.612	44.842	15.72
3.7 GPA	27.6	0	0	0	0	3	0	0	0	0	0	3.7	10.3	90.14	1.961	11.436	22.421	66.581	111.423	44.842	11.83
3.0 GPA	27.6	0	0	0	0	3	0	0	0	0	0	3	10.3	86.16	1.961	11.436	22.421	65.899	110.741	44.842	16.61
Dual Enrollment	27.6	0	1	0	0	3	0	0	0	0	0	3.38	10.3	90.00	1.961	11.436	22.421	67.581	112.423	44.842	12.00
Transfer 1	27.6	0	0	1	1	3	0	0	0	0	0	3.38	10.3	83.62	1.961	11.436	22.421	61.195	106.037	44.842	19.66
Transfer 2	27.6	0	0	1	2	3	0	0	0	0	0	3.38	10.3	80.62	1.961	11.436	22.421	58.203	103.045	44.842	23.25
Transfer 3	27.6	0	0	1	3	3	0	0	0	0	0	3.38	10.3	77.63	1.961	11.436	22.421	55.211	100.053	44.842	26.84
Transfer Associate Degree	27.6	0	0	1	1	3	1	0	0	0	0	3.38	10.3	79.11	1.961	11.436	22.421	56.688	101.530	44.842	25.07
WSU Associate Degree	27.6	0	0	0	0	3	0	1	0	0	0	3.38	10.3	85.75	1.961	11.436	22.421	63.333	108.175	44.842	17.10
one major change	27.6	0	0	0	0	1	0	0	0	0	0	3.38	10.3	91.38	1.961	11.436	22.421	68.955	113.797	44.842	10.35
failed	27.6	0	0	0	0	3	0	0	1	0	0	3.38	10.3	86.00	1.961	11.436	22.421	63.577	108.419	44.842	16.80
withdrew	27.6	0	0	0	0	3	0	0	0	1	0	3.38	10.3	84.74	1.961	11.436	22.421	62.320	107.162	44.842	18.31
repeated	27.6	0	0	0	0	3	0	0	0	0	1	3.38	10.3	83.56	1.961	11.436	22.421	61.144	105.986	44.842	19.72
failed and repeated	27.6	0	0	0	0	3	0	0	1	0	1	3.38	10.3	81.24	1.961	11.436	22.421	58.822	103.664	44.842	22.51
withdrew repeated	27.6	0	0	0	0	3	0	0	0	1	1	3.38	10.3	79.99	1.961	11.436	22.421	57.565	102.407	44.842	24.02

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