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Walden University

College of Management and Technology

This is to certify that the doctoral study by

Anne Williams

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2015

Abstract

Evaluating a Strategic Initiative's Efficiency to Enhance Community College Financial Sustainability

by

Anne S. Williams

MBA, Temple University, 1983

BA, University of Connecticut, 1978

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

Walden University

September 2015

Abstract

During the first decade of the 21st Century, U.S. college enrollment rates increased, public funding fell by 30%, oversight structures changed, and funding algorithms switched to outcome-based metrics such as retention, progression, and graduation rates. Drawing from Vroom's expectancy theory, the purpose of this correlational study was to provide decision makers with information about the factors associated with an implemented strategic initiative at a Connecticut community college. The research question addressed the correlation between the strategic initiative, retention, and organizational financial sustainability using hierarchical, binary regression analysis of archival data for 2,558 first-time full-time students at a Connecticut community college. Hosmer and Lemeshow testing [$\chi^2_{HL}(8, N = 2558) = 2.964, p = 0.937$] indicated that a relationship existed between completion of the initiative, grades, and retention while controlling for student demographic variables. Overlapping 95% CIs for participant and nonparticipant retention probabilities demonstrated that the participants and nonparticipants might have similar retention behavior. Educational business leaders may benefit from these findings by reevaluating the design, implementation, and assessment of the strategic initiative, eliminating conflicting initiative goals, and researching additional student attributes or environmental factors that correlate with student retention leading to improved institutional financial sustainability. The implications for social change include growing students' human capital to enhance the community's social welfare.

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I would be remiss if I did not acknowledge the support of my peers, students, and administrators. My students demonstrate the dedication required to change their lives and become life-long learners. My peers boosted my morale during the slow times and provided guidance on the writing and analysis found in my study. My college opened the doors to looking at a problem in a new way, permitting me the opportunity to conduct the research regarding a strategic initiative's outcomes and the institution's financial sustainability.

Thank you, you each made a difference in my journey.

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Section 1: Foundation of the Study

Strategic planners identify goals and create action plans for attaining the organization's mission through the efficient use of the organization's limited resources. However, some resource allocation decision-makers ignore cost factors in making decisions (Hollands et al., 2014). Furthermore, resource allocation decision-makers often fail to consider the efficiency of past decisions in reaching new decisions (Belfield, Crosta, & Jenkins, 2014). This access to timely data on resource allocation efficiency supports the maximization of organizational outcomes (Bryson, Patton, & Bowman, 2011). Thus, conclusions from the examination of the information needs of decision-makers provide insights for executive decision-makers and suggestions for improving the resource allocation decision-making processes.

Background of the Problem

Community college presidents have implemented strategic initiatives focused on improving institutional financial outcomes (McNair, Duree, & Ebbers, 2011). In particular, Connecticut community college administrators have faced a rapidly changing regulatory environment, including changing oversight structures, reductions in public funding, evolving funding algorithms, new curriculum mandates, and changing accountability standards, including a no-deficit funding mandate for each institution (R. Boune, personal communication, January 28, 2014). In 2012, Connecticut's budget allocation declined to 45% of the community college system's total revenue (National Center for Education Statistics [NCES], 2014a). An increased emphasis on outcomes over access to higher education has resulted in shifting stakeholder interest toward understanding factors influencing student success (Stange, 2012).

Evaluating the organizational level outcomes of initiatives has included providing an evidence-based review of organizational effectiveness in reaching goals (Luskin & Ho, 2013). Effective educational systems require efficient resource allocation and evaluation processes, providing institutions with usable information on program effectiveness (Grubb & Allen, 2011). Feedback loops with quantitative summaries have facilitated organizational change and goal attainment (Brown & May, 2012).

Public community college funding algorithms often included student outcome metrics for the NCES tracked cohorts (Dougherty, Natow, Bork, Jones, & Vega 2013). One Connecticut community college (CCC) offered students the New Student Advising and Registration (NSAR) program designed to increase the school's *retention rate* and *graduation rate*. Annually, the CCC allocates about $300,000 for the NSAR program (M. Rizzo, personal communication, July 8, 2015). Administrators might improve future decision-making and their institution's financial sustainability by understanding the relationship between student demographic factors, NSAR completion, academic outcomes, and retention, including any relationship to changes in the college's financial condition. The strategic evaluation process assesses the alignment of initiative outcomes with stakeholder priorities (Bryson et al., 2011). The strategic goals for the administrators at the CCC focused on maximizing organizational outcomes, including avoidance of a budget deficit (K. Dennis, personal communication, November 5, 2013). In the background to the problem, I identified the potential gap in strategic decision-makers' knowledge of outcomes and their relationship to financial sustainability. The focus now shifts to the problem statement.

Problem Statement

In 2011–2012, the total budget for U.S. public community colleges exceeded $54 billion (NCES, 2013), and stakeholders increased their demands for expanded transparency, accountability, and outcomes from public administrators (Travis, 2013). During the first decade of the 21st Century, U.S. college enrollment rates also rapidly increased (Hussey & Swinton, 2011), while public funding declined by 30% (Baum, Kurose, & McPherson, 2013). The general business problem is that some executives, researchers, and policymakers do not consider cost factors in analyzing the efficiency and productivity of implemented decisions. The specific business problem is that some college administrators have little information on the relationship between student demographic factors, completion of NSAR, academic outcomes, and retention that could affect institutional financial sustainability.

Purpose Statement

The purpose of this quantitative, correlational study was to inform college administrators about the relationship between the independent variables of student demographic factors, completion of NSAR, grade point average (GPA), and the dependent variable of retention, and the effect on institutional financial sustainability. The planned financial sustainability measurement tools included *cost-benefit analysis* (CBA; Levin & McEwan, 2002) and *cost-effectiveness analysis* (CEA; Grubb & Allen, 2011) in alignment with values-engaged evaluation (VEE; Greene, 2013). The population for this study was the fall 2011 to 2013 NCES tracked *first-time–full-time cohort (FT-FT)* student cohorts at the CCC.

Student demographic variables included enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness (Tinto, 1982). The potential academic outcome variables included credits earned and grade point average (Tinto, 2012). Changes in retention affected an organization's financial outcomes (DeShields, Kara, & Kaynak, 2005). Therefore, resource allocation decision-making effectiveness might improve with a better understanding of the relationship between the strategy's costs, outcomes, and the college's financial results. The findings from this study might improve resource allocation decision-making supporting gains in student educational outcomes leading to increases in society's labor productivity, income growth, and improved quality of life.

Nature of the Study

The methodology of this study was quantitative. Understanding the relationship between the implementation of a strategic initiative and the organization's financial sustainability required the evaluation of customer (student) retention and changes in revenues and expenses. The quantitative method supported the identification of meaning through the interpretation of numerical data by using mathematical models independent of the researcher (Tillman, Clemence, & Stevens, 2011). The choice of a quantitative research design also supported the generalizability of the conclusions across groups (Gelo, Braakmann, & Benetka, 2008). By focusing on a quantitative, statistical approach, the analysis of events moved beyond the qualitative design's emphasis on understanding participants' lived experiences and subjective perceptions (Mayoh & Onwuegbuzie, 2015). A qualitative approach would not have provided decision-makers with pragmatic data on the relationship between the implemented strategic program and the organization's financial sustainability.

Researchers use statistical, correlation computations in measuring the relationships between predictor variables and criterion or outcome variables, including the relative importance of predictor variables (Nimon & Oswald, 2013). The use of a correlational design focused on relationships in place of causation and eliminated validity concerns regarding causal ties between independent and dependent variables (Nimon & Oswald, 2013). Experimental designs with the assignment of human participants to treatment and nontreatment groups, when the outcome might have disparate results, would have introduced an ethical dilemma into the study and required close, long-term monitoring of impacts on participants (Wiles, Coffey, Robison, & Prosser, 2012). The nonexperimental, correlational design aligned with the purpose of the study and limited the need for the monitoring of individual long-term outcomes.

Research Questions

Executives have implemented strategic initiatives using scarce resources. In addition, community college administrators have sought growth in student outcomes. At the same time, improvements in student outcome metrics have influenced the college's financial resources based on changes in revenue from public allocations, tuition, and private sector funding streams (Schuh & Gansemer-Topf, 2012). The primary research question was the following: What is the relationship between the independent variables of student demographic factors, completion of NSAR, GPA, and the dependent variable of retention, and the effect on institutional financial sustainability?

A quantitative, multiple, correlational design provided a foundation for examining the relationship between the predictor variables and the criterion variable (Nimon & Oswald, 2013). The predictor variables were student demographic factors, NSAR completion, and academic outcomes. Student demographic factors included enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness. Academic outcome variables were cohort member first academic year results including number of credits earned and GPA.

NSAR is a strategic initiative at the CCC designed to grow student outcomes including retention, reenrolling at the college for the next fall semester. The college strongly encourages voluntary student completion of NSAR before the start of the student's first semester. Student success outcomes are critical success factors for the state and college strategic initiatives.

The CCC's Strategic Plan 2010-2015 (Strategic Plan; 2012) included student success as an organizational goal. At the state regulatory level, the Connecticut's Board of Regents for Higher Education (BOR) Transform CSCU 2020 strategic plan's goals included the student success metrics of retention, earning credits, and graduation rates (Connecticut State Colleges & Universities: Board of Regents for Higher Education [CSCU-BOR], 2013). Growing the student retention metric influenced the college's financial resources based on changes in public funding, changes in tuition and fees, and changes in private sector funding streams (Schuh & Gansemer-Topf, 2012).

A research question identified the longitudinal relationship between the predictor variables of student demographic factors, NSAR completion, academic outcomes, and the retention criterion variable at the CCC for the fall 2011-2013 NCES cohorts. The statistical tool for testing the relationship between the predictor and criterion variables was hierarchical, binary logistic regression. The inclusion of the nonfocal, student demographic and academic outcomes variables provided a deeper understanding of the overall relationship between the focal, predictor variable, and the criterion variable (O'Neill, McLarnon, Schneider, & Gardner, 2013).

Research Question 1 (RQ1): What was the relationship between NSAR completion, number of credits earned, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness?

Hypothesis Set

The hypotheses are as follows:

Null Hypothesis (H_o): There was no relationship between NSAR completion, number of credits earned, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness.

Alternative Hypothesis (H_a): There was a relationship between NSAR completion, number of credits earned, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness.

Theoretical/Conceptual Framework

Building an understanding of the relationship of student demographics, NSAR completion, academic outcomes, and retention with the institution's financial results required understanding the innovation process, student expectation–effort relationships, and the net change in financial outcomes. In 1964, Vroom introduced the valence–instrumentality–expectancy theory (VIE) describing the decision-making process as an evaluation of the potential outcomes and associated efforts (Vroom, 1984). Tinto (2012) extended the understanding of the decision-making process through interactionist theory discussing how students reach retention decisions. Decision makers using the VIE process consider how initiatives might change student behavior in determining the potential outcomes from a strategy. VEE provided a framework for the numerical analysis of program outcomes incorporating multiple stakeholder perspectives (Berger & Lyon, 2005).

Vroom's Valence-Instrumentality-Expectancy Theory

Examining the results for the NSAR program implemented to grow retention and graduation (RG) outcomes highlighted the importance of understanding executive decision-making actions and student motivations for their RG decisions. In 1964, Vroom explained decision-making processes using the VIE model (Vroom, 1984). Individuals determined the valence or perceived value of the outcome by evaluating the relationship between an alternative action and their desired outcome (Vroom, 1984). Individuals estimated instrumentality as the relationship between the requirement for the planned action and the possible outcomes, an outcome–outcome relationship (Vroom, 1984). Expectancy is the subjective probability that a given effort will result in the desired outcome (Kermally, 2005).

An individual's willingness to undertake an action is a function of the probability of anticipated outcomes and the value of the outcomes based on the decision-maker's perception (Vroom, 1984). An executive's VIE perceptions might explain decision-making practices related to implementation of a strategic initiative. Thus, the application of expectancy theory to student decision-making indicates that students used an iterative process in revising their academic goals based on gaps in goal attainment (Radosevich et al., 2009).

Tinto's Interactionist Theory

Researchers have identified relationships between how students valued outcomes, determined their effort level, and made their academic decisions that were similar to VIE decision-making processes. Since 2005, Tinto (2012) refined the interactionist theory of student behavior. Tinto's interactionist theory explained changes in student retention in relationship to the student's social and academic interactions with the institution. Researchers have demonstrated interactionist theory by documenting the relationship between student demographic factors, academic experiences, and retention at the college using hierarchical logistic regression (French, Immekus, & Yen, 2005). Developing programs that engage students in social activities including clubs or athletics, establishing high expectations for academic performance, and increasing interaction with faculty outside of the classroom increased the probability of reenrollment (Tinto, 2012). Furthermore, providing students with advising, course selection assistance, information about support services, and an introduction to a peer group before or at the very beginning of a student's first semester increased the student's identification with the college and retention decisions (Tinto, 2012). Hence, strategically reaching out to matriculating students with advising, career exploration, course selection, and social interactions with peers, faculty, and staff through NSAR might enhance student social and academic integration at the CCC, and positively relate to a student's decision to reenroll at the college.

Value-Engaged Evaluation

A VEE analysis supports measuring NSAR's success in reaching the retention goal. Alternative VEE ratios might consider the financial consequences associated with alternative goals, including degree completion, wage rates, or risk taking behavior. These alternative approaches aid decision-makers as they consider the goals of multiple stakeholders and the CCC's financial sustainability. Some organizational leaders regularly examined their understanding and perceptions using value-laden concepts (Alvesson & Spicer, 2012).

A careful evaluation of key stakeholder outcomes using VEE informs decision-makers of the results of implemented policies. Defining and then measuring good outcomes also required value judgments in evaluating quality and efficiency (Greene, 2013). Factors influencing the choice of values included the relative power of stakeholders, biases of the evaluator, and the intended purpose of the evaluation (Greene, 2013). VEE analysis systematically measured gains and movement towards stakeholder desired outcomes (Hansen, Alkin, & Wallace, 2013). In addition, value-based evaluation systems promote accountability of the programmatic impact and efficiency of interventions (Patton, 2012). Considering the program's financial implications, using both cost-effective analysis of cost per unit of change in an outcome and cost-benefit analysis of the net change in financial results, applies VEE's program impact evaluation across stakeholder groups.

Definition of Terms

Cost-benefit analysis (CBA): A financial analysis process for evaluating alternative projects or project outcomes using the difference between the project's total monetary benefits and total monetary costs with opportunity costs (Levin & McEwan, 2002).

Cost-effectiveness analysis (CEA): A method for comparing alternative projects or evaluating the project's outcomes using the ratio of the project's total costs and the change in the monetary or nonmonetary parameter yielding the cost per unit of change in outcomes (Levin & McEwan, 2002).

Fall cohort: The set of new students enrolling at the institution as first-time–full-time students during the fall semester (NCES, 2014b).

First-time student: A student enrolled at the college without earlier enrollment at another college or university (NCES, 2014b).

First-time–full-time cohort (FT-FT): The NCES reporting category of all new full-time degree-seeking students who began college in the fall semester (Tinto, 2012).

Full-time student: A student registered for a minimum of 12 credits in undergraduate degree courses (NCES, 2014b).

Graduation rate: The percentage of students who complete their degree within 150% of the standard completion time, 3 years for community college students, at the same institution (Student Right-to-Know and Campus Security Act, 1990).

One hundred and fifty percent on-time graduation rate: The percentage of students who completed their degree program without transferring within 150% of the standard time to completion (Tinto, 2012).

Retention rate: The proportion of the new fall first-time–full-time students who reenroll at the same institution the next fall or earned a certificate in 1 academic year (NCES, 2014b).

Assumptions, Limitations, and Delimitations

Stating the assumptions, limitations, and delimitations of the research project highlighted possible areas of bias, influence, or problems with the generalizability of the conclusions based on the analysis of the data. Developing common methods might improve the consistency of program evaluation across evaluation methods through detailed statements of assumptions and goals (Mark & Henry, 2013). Interpreting the results of a statistical analysis requires an understanding of the sampling techniques, data collection methodology, and research conditions that might influence the relationship between the data and the population (Nimon, 2012).

Assumptions

Understanding the underlying assumptions about the truth of the study's information and processes was integral in determining the value of the written conclusions (Gelo et al., 2008). The violation of underlying assumptions might result in an increased likelihood of Type I and II errors (Nimon, 2012). NSAR is a strategic initiative of the CCC focused on improving student experiences aimed at growing the retention metric for the college (B. Johnson, personal communication, November 25, 2013). In another study, improvements in the retention rate led to revenue gains for the college through additional tuition revenue and increased public funding allocations (Schuh & Gansemer-Topf, 2012).

I assumed that my contact with cohort students through my faculty position at the CCC and BOR committee work had a nonsignificant impact on the retention outcomes for the studied cohort groups. My responsibilities included advising the Student Government Association, creating a new academic exam preparation program, three presentations at New Student Orientation (NSO) in 2011-2012, and limited participation as a NSAR advisor for the fall 2011 cohort. My contact with FT-FT cohort students through teaching, student advising, and student government association advising occurred after the start of the student's first academic term and does not influence a student's decision to complete NSAR.

A violation of an underlying assumption with the design and revision of NSAR indicates the possible loss of an opportunity for strategic growth at the community college level. Any gap between the most effective design for NSAR and the current NSAR design indicates areas for improvement. Closing the design optimization gap might enlarge the net financial gain or reduce the net loss for the college and was beyond the scope of this study.

Several assumptions applied to using statistical models such as hierarchical logistic regression. As with any model, I assumed that the model created would be well defined and the variables accurately measured. Appropriately defining parameters with efficient measurements leading to the development of unbiased estimators of the criterion variable was an important component of research design (Williams, 2012). In addition, the predictor variables were assumed to have nonlinear relationships with each other so that two predictor variables did not measure the same construct (Tonidandel & LeBreton, 2010). Multicollinearity testing evaluated the size of the standard error term for the predictor variables.

The use of a hierarchical statistical analysis documented the relationship between the focus variables of NSAR participation and academic success factors and each student's retention decision while controlling for student demographic attributes. In using hierarchical logistic regression statistical analysis, researchers assumed that the existence of a linear logistic relationship between the independent predictor variables and the dichotomous criterion variable (Tonidandel & LeBreton, 2010). The comparison of the absolute value of regression residuals to the absolute value of the critical value along with a scatter plot of the regression residuals documented the extent of the variance between the model's predictions and the data set values.

Limitations

Beyond knowledge about the reliance on assumptions, a discussion of the limitations of the study highlighted possible design or interpretation gaps associated with the researcher's actions (Tillman et al., 2011). Challenges related to data collection, variable definitions, and scale choices placed limitations on research results (Charlwood et al., 2014). The use of archival data sources limited possible challenges in time, costs, and accuracy associated with independently collecting data from a large group of individuals (Greenhoot & Dowsett, 2012).

The study of the financial sustainability outcomes related to the NSAR program at one CCC demonstrated the relationship of the strategic initiative designed to grow customer retention and financial sustainability at one organization. The documentation and institutional knowledge on the design and implementation of NSAR provides an opportunity for other colleges to analyze potential outcomes in introducing a similar strategic initiative focused on student retention through an early advising support system. The use of local cost factors in place of national resource pricing information limited the geographic scope for the generalizability of a researcher's conclusions (Hollands et al., 2014). The effectiveness of implementing a program at a different organization depends on the allocation of appropriate human and capital resources, the level of motivation and support by the faculty and staff team members, and student attributes. Assuming a similar student body, the NSAR program should yield similar results at similarly situated and motivated institutions.

The choice of the population for the study might influence the generalizability of the study. Limiting the study to FT-FT student cohort members might limit the generalizability of the results to all students newly enrolled at a community college because of possible attribute differences between groups. Variables not identified or considered in this study might also influence a student's self-selection into NSAR.

Moreover, the knowledge and skills of the instructor and mentors along with possible interactions between students might influence a NSAR session's outcomes. These factors were not controllable in this research study. Misspecification of the statistical model might overlook important variables or suppress results due to predictor variable interrelationships (Nathans, Oswald, & Nimon, 2012; Tonidandel & LeBreton, 2011). Future research might consider additional quantitative parameters along with qualitative factors, including student attitudes, emotions, and feelings surrounding the student's first academic year.

A possible flaw introduced by the use of CEA analysis is the failure to measure more than one outcome. Some programs may result in improvements in more than one parameter (Hollands et al., 2014). The evaluation process used in measuring the financial consequences related to an implemented strategic initiative using cost-effectiveness analysis and cost-benefit analysis is generalizable to other colleges.

Delimitations

A critical factor in determining the usefulness of a researcher's conclusions is forming an understanding of the work's breadth while stating what the study did not include. The generalizability of the study is delimited by the interaction of the choice of research questions, participants, and research methods chosen by the researcher (Tillman et al., 2011). The analysis of this CCC's NSAR program results from the fall 2011–2013 FT-FT cohorts provided insights into the outcomes of a paradigm shift toward an early intervention approach to support growth in retention outcomes. The 2011-2013 NSAR study period coincides with a period of falling public funding allocations to community colleges and high local unemployment rates. Unobserved variables not included in the analysis might contribute to changes in student retention decisions beyond any relationship with a student's NSAR completion.

In designing and revising NSAR, the large, urban community college considered the special needs of its student population composed of a high percentage of first-in-family college enrollees and underprepared students (B. Johnson, personal communication, November 25, 2013). Other communities might have different financial outcomes because of significant differences in the student population requiring adaptation of NSAR before implementation in the new environment. The process of revising NSAR's design features might reduce the probability of replicating NSAR's outcomes. Additionally, alternative communities might have different revenue and cost structures that might influence the cost-effectiveness ratio and the cost-benefit value. The findings and results from the present study, reflecting the experiences at a large, urban community college in Connecticut, may or may not generalize to NSAR implementations with different stakeholders, under different economic conditions, or a changed regulatory climate.

Significance of the Study

Community college executives reach resource allocation decisions that influence the financial sustainability of their institution, the students, the community, and other stakeholders. Understanding the financial sustainability results of prior decisions might improve future decision-making. Improved decision-making by college administrators might improve the economic and social well being of the community including students, their families, businesses, and society.

Contribution to Business Practice

Financial sustainability in public and private enterprises requires the appropriate allocation of human and capital resources responding to the demands of the organization's multiple stakeholders (Bryson et al., 2011). New pressure by the general public and public oversight boards call for greater accountability of outcomes related to the use of allocated public funds (Travis, 2013). Some of the challenges faced by college administrators and oversight boards have included operating with limited statistical information documenting outcomes (E. W. Carter et al., 2013). The lack of common definitions of institutional and student success has limited the generalizability of past research on outcomes and mission attainment in higher education (Jenkins & Rodriguez, 2013; Moskal, Dziuban, & Hartman, 2013).

The 2008 economic recession resulted in U.S. states rebalancing their funding of higher education and other public services. Connecticut reduced public funding for the state's public, community colleges (Altundemir, 2012). Reductions in state funding caused public higher education institutions (HEIs) to shift their reliance toward tuition and fee revenue sources (Altundemir, 2012). Retaining students from their first to their second year continues the tuition and fees revenue stream into future years without the costs associated with replacing students who dropout with recruited transfer students (Schuh & Gansemer-Topf, 2012). Therefore, decision-makers need access to timely and accurate information on the effectiveness of allocated resources to maximize their organization's outcomes (Bryson et al., 2011).

Activity-based funding methods and outcome-based funding methods encourage resource allocation decisions based on changes in incentivized outcomes without considering changes in costs (Sexton, Comunale, & Gara, 2012). The refocusing of public funding formulas toward efficiency-based methods redirected administrators' decisions toward seeking the greatest positive outcome at the lowest cost (Sexton et al., 2012). Decision-makers who used a VEE analysis of program success might place more importance on attaining stakeholder goals over possibly conflicting organizational goals (Luskin & Ho, 2013). Growing the community college's NCES FT-FT group's retention rates should increase tuition revenue and grow public funding resulting in improved operating results for the CCC and meet stakeholder calls for outcome accountability.

Decision-makers have evaluated operating efficiency in determining which outcome goals merited resource allocations (Duncombe & Yinger, 2011). Providing decision-makers with data driven evidence of outcomes supplements their reliance on intuition and advice seeking decision processes (Francis-Smythe, Robinson, & Ross, 2013). Three possible gains resulting from more informed decision-making are more accurate prediction of outcome probabilities, greater sensitivity in determining outcome instrumentality, and a larger positive valence (Vroom, 1984). Through a quantification of the outcomes associated with past resource allocation decisions, the accuracy of the executive's estimation of the valence or value of the predicted outcome of future resource allocation decisions might improve. The use of CEA and CBA provides a framework for quantifying the results of past policy decisions. Decision-making processes supported by analysis of past outcomes might also support more efficient decision-making leading to improved operating results and greater institutional financial sustainability.

Implications for Social Change

Community colleges provide educational opportunities for their community, but recent 3-year national average graduation rates of 20% (NCES, 2014a) and Connecticut rates of less than 10% (Strategic Plan, 2012) suggest that there are lost opportunities for student success. Successful retention strategies increase student success outcomes (Saltzman & Roeder, 2012). Decisions supported by accurate and timely valence, instrumentality, and expectancy projections might improve administrators' resource allocation decision-making supporting gains in student educational outcomes.

Numerous stakeholder groups including the students, student families, the local community, and the state benefit from improved RG rates and a more educated labor force. Gains associated with higher education increase family incomes (Oreopoulos & Petronijevic, 2013) and improve educational outcomes for family members (Zhan & Sherraden, 2011). Individuals and their family benefit from improved quality of life including (a) less criminal activity (Grubb, 2002b), (b) reduced reliance on welfare programs (Grubb, 2002a), (c) increased healthy choices (Belfield & Bailey, 2011), and (d) expanded community involvement (Brady, 2013).

Businesses, local, and state governments also benefit when citizens complete additional years of higher education. As workers improve their skill sets, employers maintain and grow their market competitiveness (Carruth & Carruth, 2013). The shift away from welfare, healthcare, and prison costs permits the reallocation of funds to higher education, providing enhanced learning opportunities for future students (Brady, 2013). Moreover, higher wages result in increased tax revenue based on property tax, sales tax, and income tax policies. Finally, a community with more skilled workers might support the demands of the business sector for a highly educated workforce, improve the community's living standard, and provide students and their families with economic advantages.

A Review of the Professional and Academic Literature

The presentation of a review of the professional and academic literature documented the foundation for the study of what information decision-makers need on the relationship between student demographics, NSAR completion, academic outcomes, and retention with the financial outcomes for the CCC. This literature review includes a summary of the research supporting the analysis of the hypothesized statistically significant relationship between a NSAR completion, GPA, number of credits earned, and the student's retention decision while controlling for student's enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness. The literature review was topically organized reflecting the research method and design, theoretical background, data sources, similar research studies, statistical and financial analysis techniques, variable descriptions, and the changing higher education environment. Databases used in conducting the literature review included Thoreau, Academic Search Complete, EBSCO Host Business Source Complete, Gartner, Google Scholar, and ProQuest ABI/Inform Complete. Emerald Management Journals and SAGE Premier search engines provided access to multiple journals published by the named publisher. I used Ulrichsweb Global Serials Directory (ulrichsweb.serialssolutions.com.) in determining the peer-reviewed status of the journals. Data searches of databases maintained by the U.S. Department of Education included the NCES and Integrated Postsecondary Education Data System (IPEDS) Data Center.

Forward and backward data-mining processes included reading articles cited in the retrieved articles along with articles that cited the retrieved articles. Seminal work was often found in book form either as a bound journal not available on the Internet or edited books presenting updates to seminal research. Keyword searches included *cost-benefit analysis, cost-effectiveness analysis, graduation, logistic regression, multiple regression, retention, statistical techniques, values-engaged evaluation,* and *values-instrumentality-expectancy theory*. Key name searches including Bahr, Greene, Patton, Tinto, and Vroom aided in the identification of seminal articles and articles building upon the foundational research.

In compliance with Walden University's Doctor of Business Administration requirements, 203 references appear in the literature review with 178 (88%) peer-reviewed articles, 176 (87%) published between 2011 and 2015, and 8 (4%) from government data resources or statutes. The purpose of this quantitative, correlational study was to inform college administrators about the relationship between the independent variables of student demographic factors, completion of NSAR, GPA, retention, and institutional financial sustainability. This information could help college administrations make more informed resource allocation decisions, improve organizational accountability, and garner additional public funding under performance based funding algorithms.

Research Method

The three research methods are qualitative, quantitative, and mixed methods (Tillman et al., 2011). The standards used in the quantitative method support the explanation of phenomenon and generalization of the researcher's conclusions (Tillman et al., 2011). The research methods each contained weaknesses, and researchers who combined approaches have yielded improved, deeper understanding (Tillman et al., 2011). At the onset of a research process, researchers align the research method and research question (Gelo et al., 2008; Tillman et al., 2011). The exclusive use of the quantitative method requires that all questions and hypotheses could be answered using quantitative techniques (Tillman et al., 2011).

The chosen research method must match the research question (Tillman et al., 2011). Each research method includes guidelines for data collection and analysis creating a platform for reviewing the stated phenomenon (Gelo et al., 2008). Quantitative research supports the numerical analysis of phenomenon using descriptive, inferential data analysis, and deductive reasoning (Tillman et al., 2011). Qualitative research questions require thematic data and develop descriptive, interpretive analysis of a phenomenon using inductive reasoning (Tillman et al., 2011). The quantitative method supports the objective identification of meaning through the interpretation of numerical data using mathematical models independent of the researcher while qualitative research focuses on contextualization of experiences (Tillman et al., 2011). By adopting a quantitative approach for evaluating relationships between attributes, researchers measure the statistical significance of the hypothesized relationship (Tillman et al., 2011). Moreover, research conducted using a quantitative approach is often generalizable across broad groups (Tillman et al., 2011).

Researchers describe management research using scientific inquiry in any of the research methods as a young field of inquiry often lacking clear definitions of constructs and measurement tools preventing the generalizability of the conclusions across groups (Aguinis & Edwards, 2014). The use of the quantitative method provides an opportunity for mitigating internal validity through controls over the manipulation of variables while possibly decreasing external validity because of using a single site for data collection (Aguinis & Edwards, 2014). Collecting data in a naturalistic manner by not involving the researcher in the data collection process mitigates the quantitative method's external validity problem (Aguinis & Edwards, 2014). Therefore, the advantages of employing quantitative research include improved generalizability of the researcher's conclusion tied to the scientific foundation of data supported analysis (Brousselle & Champagne, 2011).

The qualitative method was an alternative approach to understanding the phenomenon. In qualitative research, the often open-ended research questions focus on the discovery of meaning by subjectively uncovering thematic meaning and contextualization of the participant's view of reality (Tillman et al., 2011). The qualitative method requires research questions focused on the identification of themes in narrative data acquired through interviews and focus groups (Gelo et al., 2008). The focus on decision-making and effectiveness of implemented strategies for growing outcomes did not align with qualitative analysis' focus on determining new relationships.

Qualitative analysis, especially the use of interviews, was frequently used in psychoanalytic research using practitioner's case files to understand the complexities of human perception (Tillman et al., 2011). The qualitative method supported the discovery and analysis of themes identified in the data (Mayoh & Onwuegbuzie, 2015). Collecting participants' lived experiences supported the deep understanding of a stated phenomenon (Venkatesh, Brown, & Bala, 2013).

The iterative process of reviewing the qualitative data required the comparison of categorized, participant statements with identified categories of phenomenological perception (Gelo et al., 2008). The qualitative approach relied on the contextualization of participant perceptions in a dynamic environment (Tillman et al., 2011). Inconsistency in the coding of some qualitative data might obscure true relationships and erroneously identify untruths (Vaitkevicius & Kazokiene, 2013). Determining the sample size necessary for documenting saturation of ideas where no new themes are added presents an obstacle for researchers using the qualitative method (O'Reilly & Parker, 2013). The quantitative method aligned with the purpose, research questions, and available data.

Multiple Correlational Research Design

Experimental design, an approach for quantitative analysis, permitted the comparison of outcomes for treatment and nontreatment groups and the analysis of cause and effect patterns (Wiles et al., 2012). The experimental design requires random assignment of a large number of participants to the treatment or nontreatment groups in assessing differences in outcomes for two groups (Gelo et al., 2008). The use of a nonexperimental research design permits the collection of data in a naturalistic setting supporting the collection unconstrained participant factors (Gelo et al., 2008).

At the CCC, matriculating students voluntarily completed or did not complete the NSAR (B. Johnson, personal communication, November 25, 2013). Self-selection into the treatment group might reflect difficult to quantify attributes such as student motivation (Bettinger, Boatman, & Long, 2013). Experiments with treatments that potentially result in significant differences in long-term outcomes for human participants present ethical issues and require long-term monitoring of impacts on participants (Wiles et al., 2012). Experimental processes that recruit student participants using rewards such as payment or course credit introduced ethical dilemmas into the research process (Leentjens & Levenson, 2013). The choice of a nonexperimental design mitigated the ethical issues and the requirement for long-term documentation of treatment outcomes.

Researchers use different research design strategies in evaluating the impact of decisions on an institution's retention, persistence, and graduation metrics. Research on the change in RG rates used an institution's anonymous, archival data set containing information on students who did and did not complete a library skills course (Cook, 2014). Statistical testing used to document the relationship with retention included annual and longitudinal chi-square testing of differences in means between groups with the analysis of the control variables of age, college GPA, high school academic results, and socioeconomic group (Cook, 2014). In a separate study, a survey using a random sample of criminal justice students supported the evaluation of the influence of participation in service-learning on student outcomes (Gutierrez, Reeves-Gutierrez, & Helms, 2012). Participants in random sample designed studies require additional privacy protection safeguards (Gutierrez et al., 2012).

The use of the correlation design supported the understanding of the relationships between predictor and criterion variables, including the relative strengths and interrelationships between variables (Nimon & Oswald, 2013). The validity of a researcher's conclusions was a function of the alignment of the statistical analysis tools, sampling, and quality of the population's data (Nimon, 2012). Conducting the statistical analysis using a correlational design permitted greater understanding of the relationship between the parameters of student demographics, NSAR completion, academic outcomes, and retention. The correlation approach eliminated the challenges associated with an experimental design and the need for separate analysis of differences between treatment and nontreatment group member attributes (Nimon & Oswald, 2013).

Reliability and Validity

One of the goals of management researchers is the development of knowledge with an understanding of how practitioners might use the information (Aguinis & Edwards, 2014). Rice (2013) stated that reliability refers to the accuracy of the measurement of the data points. Reliability consists of three categories: test–retest, consistency, and interrater reliability (Rice, 2013). If the instrument returns an identical measurement each time it measured the same item, then the instrument met the reliability standard (Rice, 2013). Researchers cautioned that student misrepresentation of data, either intentionally or inadvertently, reduced the reliability of student self-reported datum (Kahu, 2013).

Validity indicates if the measurement measures the intended construct (Rice, 2013). The internal validity of research reflects the confidence of the researcher in their causal conclusions (Aguinis & Edwards, 2014). Experimental designs with random treatment group assignment and variable manipulation had high internal validity (Aguinis & Edwards, 2014). Whereas, the use of a correlational design focused on relationships in place of causation eliminating validity concerns regarding causal ties between independent and dependent variables (Nimon & Oswald, 2013).

External validity of a research project examines the generalizability of the author's conclusions in diverse contexts or geographic domains (Beal & Pascarella, 1982). Aguinis and Edwards (2014) determined that the external validity of management research would improve with the standardization of measurement tools and constructs. Research designs that used experimental or quasi-experimental designs introduced external validity issues based on the selection of the treatment and nontreatment groups (Aguinis & Edwards, 2014). Using data collected in the course of business operations, a natural setting reduced the external validity threats (Aguinis & Edwards, 2014).

Theoretical Background

After evaluating leadership competencies of U.S. community college presidents, researchers concluded that the president's level of program evaluation skills played a key role in organizational sustainability and mission alignment (McNair et al., 2011). Approximately 70% of organizational change initiatives failed in reaching their desired outcomes (Prindle, 2012). Organizational efficiency required leaders with situational awareness and the ability to balance conflicts in stakeholder needs (Guay, 2013). Additionally, management researchers shifted their focus to the development of best practices that support the development of better outcomes (Sekerka, Comer, & Godwin, 2014).

Both VIE theory and VEE analysis support the development of the understanding of decision-making criteria and the evaluation of a decision's outcomes. The alignment of values and consideration of values plays an important role in leadership theory research (Dinh et al., 2014). In making resource allocation decisions, leaders have aimed at increasing organizational value and sustainability (Dinh et al., 2014). Providing decision-makings with additional information on the implications of past decisions on institutional financial outcomes might improve future decision-making.

Vroom's VIE theory. Vroom (1984), in editing his seminal work published in 1964, examined the decision-making process and determined that individuals rank alternative outcomes based on the sum of the products of their expected values and probability of occurrences. VIE defined the decision-making factors and presented a quantification method for decision-making (Vroom, 1984). Outcome ranking relied on the relative weights of valence, instrumentality, and expectancy across the possible actions (Vroom, 1984). An individual's perception of the likelihood of obtaining an outcome, the expectancy, influenced the individual's willingness to exert effort towards achieving the identified outcome (Kermally, 2005).

A summary of VIE's influence on decision-making included providing a sequential process for judging the probability of action resulting in the desired outcome and supported improved decision-making (Holland, 2011). Valence measured the desirability of a stated outcome (Vroom, 1984). Instrumentality identified the level of effort expected to yield the stated outcome (Vroom, 1984). Expectancy assigned a probability weight to the likelihood of achieving the stated outcome (Vroom, 1984). Decision-making relied on the product of the expected outcomes and their respective probabilities in determining the worthiness of expending the required effort (Vroom, 1984). Before reaching decisions, individuals determined the valence of the identified possible outcomes (Kermally, 2005). The selection of potential outcomes with high valence and high expectancy resulted in a high effort (Holland, 2011).

A description of VIE decision-making stated the belief that the perceived probability of an outcome given a level of effort yielded a desired outcome (Jean & Forbes, 2012). The decision-maker believed that performing at an understood performance level would lead to the occurrence of the stated outcome (Jean & Forbes, 2012). The performance effort included both the commitment of financial resources and time (Jean & Forbes, 2012). The VIE model related expectations with the willingness to contribute effort (Renko, Kroeck, & Bullough, 2012). Individuals exerted energy when the expected possible outcomes from their exertion yielded sufficient value to justify the effort (Renko et al., 2012). VIE decision-making included the belief that the perceived probability of an outcome given a level of effort yielded a desired outcome (Jean & Forbes, 2012).

Decision-makers sought information before reaching decisions (Savolainen, 2012). VIE theory assumes a rational decision-making process and the systematic use of a numerical ranking that based on the products of probabilities and the monetary value of potential outcomes (Savolainen, 2012). A common criticism of VIE relates to the assumption of rationality and the use of a complex decision-making protocol (Savolainen, 2012). Researchers documented the inability of a single theory of universal decision-making in capturing the complexity of human decision-making processes (Savolainen, 2012). VIE theory defined reasons why decision-makers sought information, and how they might use information in reaching a decision (Savolainen, 2012).

An additional challenge to VIE's explanation of decision-making was the relationship between group dynamics and decision-making (Ugah & Arua, 2011). VIE theory suggests that individuals expended sufficient time and effort in achieving their desired goal (Ugah & Arua, 2011). Individuals on teams sought stable team relationships and VIE's reliance on individual goals might conflict with maintaining effective team relationships (Ugah & Arua, 2011).

Several researchers applied VIE theory in evaluating decision-making in educational contexts. A study of Nigerian business students and their academic effort confirmed that students who highly valued grades expended more effort toward achieving the desired grade (Fagbohungbe, 2012). Students who did not value high grades contributed significantly less effort towards their coursework (Fagbohungbe, 2012). In a longitudinal study of business students, researchers concluded that students used an iterative process in reevaluating the outcomes from their academic decisions based on feedback loops (Radosevich et al., 2009).

VIE theory was the theoretical foundation for the study of new entrepreneur decision-making (Renko et al., 2012). After controlling for age, gender, and time lags, the researchers concluded that entrepreneurs valued monetary and nonmonetary rewards (Renko et al., 2012). Male entrepreneurs placed greater valence on financial rewards while female entrepreneurs statistically preferred personal growth and other nonmonetary outcomes (Renko et al., 2012). Some entrepreneurs employed VIE theory decision ranking even though gender influenced the choice of desired outcome (Renko et al., 2012). High valence for financial outcomes resulted in increased motivation and effort across genders (Renko et al., 2012).

An entrepreneur's perception of their abilities, financial resources, switching costs, and past experiences influenced an individual's decisions regarding entrepreneurial effort (Holland, 2011). There was a positive correlation between persistence decisions and the individual's expectancy and valence measurements (Holland, 2011). Entrepreneurs considered the expectations of others in reaching persistence decisions (Holland, 2011).

Researchers who studied bloggers using VIE theory and statistical testing identified potential rewards from blogging included intrinsic outcomes such as achievement, sharing, and expressing emotions (Liao, Liu, & Pi, 2011). The extrinsic outcomes associated with blogging included building and maintaining social relationships, gaining knowledge, and developing empathy (Liao et al., 2011). Bloggers based their intended effort on their evaluation of the potential intrinsic and extrinsic rewards from their effort (Liao et al., 2011).

Alternatively, researchers studied retention in higher education using a framework of Herzberg's two-factor theory. Published in 1959, Herzberg's two-factor theory considered the performance relationship between motivators and hygiene factors (DeShields et al., 2005). Motivators are intrinsic factors usually within the control of the individual resulting in satisfaction, while hygiene factors are extrinsic factors controlled by others producing dissatisfaction when absent (DeShields et al., 2005). Motivators and hygiene factors are not opposites because the absence of satisfaction is not dissatisfaction therefore; the measurement scales are separate (DeShields et al., 2005).

The application of two-factor theory among higher education business students demonstrated the relationship between motivators, hygiene factors, and student retention (DeShields et al., 2005). Poor academic advising experiences may lead to student dissatisfaction that does not impede a student's perception of their actual college experience against their expected college experience (DeShields et al., 2005). Institutional financial outcomes improved when administrators, faculty, and staff focused on student satisfaction in a manner similar to a business' customer satisfaction paradigm (DeShields et al., 2005). Improvements in student satisfaction resulted in revenue stream growth based on tuition indexed funding formulas (DeShields et al., 2005).

In an analysis of the job satisfaction and retention of nonPhD faculty in Pakistan, researchers isolated motivator and hygiene variables (Mangi, Soomro, Ghumro, Abidi, & Jalbani, 2011). NonPhD's job satisfaction related to both wage rates (hygiene) and promotion policies (motivator; Mangi et al., 2011). Employee demographics explained an important portion of the variance in job satisfaction among survey participants (Mangi et al., 2011). An evaluation of nursing faculty satisfaction used a two-factor foundation by looking at the relationship between institutional practices (hygiene), reward–systems (motivators), and job satisfaction concluding that dissatisfaction with low compensation did not always strongly influence employee recruitment and retention decisions (Evans, 2013). Where as, nursing faculty often placed greater emphasis on other factors such as influencing student lives (Evans, 2013).

The application of two-factor theory fails to recognize factors beyond the control of the subject and their organization. Some funding algorithms for public HEIs shifted away from state funding toward alternative funding sources (Travis, 2013). Connecticut's higher education system's rapidly changing regulatory oversight with changing funding algorithms might introduce factors that affect institutional decisions beyond student motivators and hygiene factors. External higher education stakeholders influence institutional financial outcomes beyond the variables identified as motivators and hygiene factors. In conclusion, the limitations in Herzberg's two-factor theory and the strengths of VIE theory in adapting to changing funding influences and multiple stakeholder viewpoints supported the choice of VIE for the study's theoretical framework.

Tinto's interactionist theory. A gap existed between what researchers documented and the information needs of practitioners (Tinto, 2012). HEIs often included student retention, persistence, and graduation rates in their performance metrics (Tinto, 2012). Tinto's interactionist theory of student motivation examined the relationship between student engagement and reenrollment at the institution in the second year (Tinto, 2012). The student's motivation for continuing enrollment at a college depended on the student's academic and social experiences at the college (Tinto, 2012). Students with clear academic plans who engaged with faculty mentors or succeeded in the classroom reenrolled at greater rates than other students (Tinto, 2012). Moreover, programs that grew student social networks through participation in clubs or athletics also increased the probability of reenrolling at the college (Tinto, 2012).

Students at institutions with established cultures of high academic performance standards returned at greater rates than students at HEIs with lower expectations (Tinto, 2012). Strategic processes that provided students with early access to academic advising and course selection assistance, opportunities for developing peer relationships, and information about academic and social support programming grew student retention rates from the first to the second year (Tinto, 2012). The designers of the CCC's NSAR program incorporated the retention themes outlined by Tinto's interactionist theory.

VEE. Evaluation is the process of determining the value of or judging a program or innovation (Cousins, Goh, Elliott, Aubry, & Gilbert, 2014). Public discussion and awareness of social issues expanded when evaluation processes considered the needs of all stakeholders by providing a voice to diverse populations (Greene, 2013). Decision-makers received timely and informative data when the process identified goals and desired outcomes using clear metrics (Patton, 1997). The advancement of the needs of marginalized groups did not exclude the needs of other interest groups including policy makers (Greene, 1997). Additionally, evaluation focused on broader stakeholder needs reduced bias and favoritism (Greene, 1997). The systematic use of program evaluation processes permitted the continuous assessment of socioeconomic conditions within an organization and among stakeholders (Greene, 2001). Further, an evaluator's awareness of the importance of all stakeholders' viewpoints and not focusing on a single value set resulted in increased understanding of societal conditions (Greene, 2001).

Decision-makers made satisficing choices related to how much information they require before reaching their decision (Patton, 2012). The definition of evaluation stated that the appraisal of the impact of decisions related to organizational processes focused on reaching strategic goals and resolving institutional problems (Luskin & Ho, 2013). Therefore, effective evaluation requires the articulation of desired program outcomes and goals (Hall, Ahn, & Greene, 2012). Evaluators need to understand the explicit and implicit program goals that influence decisions about program design (Hall et al., 2012).

VEE stated that the best process for evaluating decision-outcomes balanced the needs of all stakeholders, especially disadvantaged groups (Greene, 2013; Vo, 2013). Further, VEE required that the organization's culture focus on social justice supporting institutional learning (Vo, 2013). Consensus building across diverse stakeholders gave voice to underserved stakeholders during the VEE process (Miller, 2013). Each stakeholder's situational importance and the alignment with organization's strategic goals should influence decision-makers (Ackermann & Eden, 2011).

A positive relationship between organizational VEE processes and continuous improvement programs supports data driven program evaluation (Miller, 2013). Through the inclusion of stakeholder needs, VEE evaluators consider equity across stakeholder outcomes (Hall et al., 2012). Prioritizing activities based on specific stakeholder outcomes rather than relationship outcomes improved the attainment of the organization's strategic goals (Ackermann & Eden, 2011). Employing the VEE design encouraged the engagement of all stakeholders in all phases of identifying and measuring program outcomes (Dillman, 2013). Importantly, one of the primary outcomes of using VEE program evaluation processes is providing decision-makers with sufficient information and feedback for effective resource allocation decision-making (Hansen et al., 2013).

Conflicts between stakeholders might impede program evaluation using VEE (Luskin & Ho, 2013). The description of stakeholders includes anyone influenced by the program or the evaluation process (Bryson et al., 2011). The VEE process gives significant weight to stakeholder needs that might conflict with the organization's mission (Luskin & Ho, 2013). VEE's inclusion of diverse stakeholder needs might also conflict with serving the organization's mission (Hansen et al., 2013). In practice, Hansen et al. (2013) concluded that VEE practitioners often fail in measuring all stakeholder needs, indicating a gap in understanding on best practices for evaluating conflicting goals. Johnson, Hall, Greene, and Ahn (2013) concluded that expanding the reach of program evaluation improves the depth of reflection and engagement across all stakeholder groups. VEE evaluators permit all legitimate stakeholders a voice in the evaluation process (Johnson et al., 2013). However, balancing the diverse needs of diverse stakeholders requires vigilance by the evaluator (Bryson et al., 2011). In Ireland, feedback loops with revision steps and objective measurement of outcomes improved organizational strategy by addressing multiple stakeholder viewpoints. (Lillis & Lynch, 2013)

Alternative program evaluation strategies such as practical participatory evaluation (PPE) and emergent realist evaluation (ERE) differ from VEE based on the treatment of stakeholder needs (Dillman, 2013). PPE includes stakeholder values in the evaluation process and defines stakeholders as individuals with decision-making authority (Dillman, 2013). By limiting stakeholders to decision-makers, the evaluators contain the context of the evaluation to the needs and wants of the decision-makers without explicitly valuing the needs or wants of nondecision-makers (Dillman, 2013). PPE processes concentrate on the development of key information required in the decision-making process directed toward opportunities for program enhancement (Vo, 2013).

On the other hand, ERE processes focus on the decision-maker's information needs and often ignore outcomes for marginalized groups (Vo, 2013). Dillman (2013) noted that ERE values societal outcomes and consensus building while focusing on the decision-maker's desired outcomes (Dillman, 2013). Regulators and other external decision-makers rely on ERE's provision of sufficient information for their decision-making needs (Vo, 2013).

In Finland, a study of the implementation of participatory evaluation (PE) showed how evaluators struggled in determining which stakeholders to include in the evaluation process (Pietiläinen, 2012). PE evaluators valued inclusion of stakeholder needs while maintaining the fairness of the evaluation process. The use of PPE and ERE supported decision-making processes while undervaluing the needs of underserved internal or external stakeholders (Vo, 2013).

Decision-makers sometimes rely on training, experience, and assumptions about their skills overlooking logic or new evidence in reaching strategic decisions (Pfeffer & Sutton, 2006). Informed data driven decisions demonstrate a commitment to growth and the importance of challenging conventional wisdom in growing organizational outcomes (Pfeffer & Sutton, 2006). Competitive pressures, diverse stakeholder needs, and information overload challenged the ability of executives in reaching effective resource allocation decisions (Friga, & Chapas, 2008). Instead, successful organizations provided decision-makers with systematically developed, relevant data resulting in improved decision outcomes and intuitional ethics (Friga, & Chapas, 2008).

Effective and efficient executive decision-making requires access to timely, accurate, usable, and relevant information regarding organizational outcomes (Holsapple, Lee-Post, & Pakath, 2014). Business analytic programs provide organizations with mathematical and statistical platforms for distributing and using information (Holsapple et al., 2014). Data collection and analysis processes improve executive access to answers derived from the data integration processes (Wixom, Yen, & Relich, 2013). Often, decisions informed by business analytics data support strategic goals, competitive advantage, and improved outcomes (Holsapple et al., 2014). In conclusion, providing decision-makers with data driven evidence of outcomes supplemented their reliance on intuition and advice seeking decision processes (Francis-Smythe et al., 2013).

Evaluation Processes

Effective evaluation requires the researcher to ask the right questions and employ the appropriate research methodology to find answers to the questions (Patton, 2013). Deliberate, planned statistical evaluations of retention growth programs inform decision-makers of program efficiency and support resource allocation decision-making (Beal & Pascarella, 1982). In a study of Florida HEIs, researchers noted that successful institutions evaluated programs based on the needs of multiple stakeholders using quantitative and qualitative assessment of outcomes (Moskal et al., 2013). Evaluating program success requires an understanding of positive and negative program influences on outcomes (Lavine, Bright, Powley, & Cameron, 2014). Sustainable HEIs focused on collaborative approaches in meeting the competing needs of internal and external stakeholders (Fusilier & Munro, 2013). Quantification problems related to the definition of good outcomes and outcome measurement issues limited the value of past evaluation processes (Jenkins & Rodriguez, 2013).

Successful leaders demonstrated intelligence and social skills in their roles as change leaders (Ensari, Riggio, Christian, & Carslaw, 2011). Leadership success often included executive involvement in implementing well-documented change initiatives (Nwabueze, 2011). Executives adapted their leadership practices to the changing environment fostering innovation and engagement (Tse & Chiu, 2014). Decision processes often included value judgments even without stated value outcomes (Learmonth & Humphreys, 2011). Clearly stating assumptions, defining good outcomes, and including multiple perspectives improved organizational processes (Learmonth &

Humphreys, 2011). Openness to innovation supported problem solving (Rego, Sousa, Marques, & Pina e Cunha, 2012). Executives improved outcomes through improved transparency and employee understanding of the change (Rego, Sousa, Marques, & Pina e Cunha, 2014).

Cameron, Mora, Leutscher, and Calarco (2011) demonstrated the relationship between organizational sustainability and positive leadership practices. Later, Cameron, and Plews (2012) demonstrated the importance of duplicating successful strategies that improved organizational outcomes including stakeholder satisfaction. Some successful change processes built new layers of innovation on top of existing efficient programs (M. Z. Carter, Armenakis, Feild, & Mossholder, 2013). It is important to note that decision-makers often lack sufficient information on the efficiency of past decisions (E. W. Carter et al., 2013). Additionally, cross-discipline analysis played an important role in developing innovative approaches to shared concerns (Manz & Manz, 2014).

By employing developmental evaluation processes, information gathering identified outcomes across stakeholders providing data for informed decision-making (Patton, 2012). Improved consistency across evaluators and evaluation methods might enhance the efficacy of evaluation (Gargani, 2013). Providing opportunities for additional public forums with interactions between practitioners and researchers might reduce misconceptions about evaluation goals and metrics (Gargani, 2013). Developing common methods might improve the consistency of program evaluation across evaluation methods by the use of detailed statements of assumptions and goals (Mark & Henry, 2013). Furthermore, the incorporation of social value outcomes required the evaluator’s consideration of different evaluation processes (Mark & Henry, 2013). A researcher concluded that VEE's approach of inclusion of broad stakeholder views provides decision-makers with a structure for decision-making supported by facts (Miller, 2013).

Changing Higher Education Environment

Organizational goal setting imposes increasingly challenging performance goals across organizations (Welsh & Ordóñez, 2014). Goal setting with high expectations resulted in productivity gains including focused effort on desired outcomes, new knowledge, and improved organizational persistence (Welsh & Ordóñez, 2014). HEIs faced a more competitive environment with the entry of new competitors and increased calls for accountability and assessment of outcomes (Jenkins & Rodriguez, 2013). Community college administrators attempted balance reaching strategic goals and improving financial sustainability (McNair et al., 2011). Public college executives devoted resources to programs designed for maximizing public funding allocations (Fernández, Morales, Rodríguez, & Salmerón, 2011).

HEI executives used leadership strategies designed to support internal change behavior in adapting to external pressures through innovation, development, and focusing on sustainability (Lee, 2013). Shared institutional governance through committee decision-making approaches grew in popularity for nonfinancial resource allocation decisions at HEIs (Bhattacharyya & Jha, 2013). A documented disadvantage of shared decision-making is that it often increased the decision-making time line (Purslow & Florence, 2010). Leadership researchers documented that some leaders adapt their behavior in changing business climates (Dinh & Lord, 2012; Zaccaro, 2012). The lack of a common definition of leadership by researchers that studied public and private entities reduced the generalizability of all leadership research (Hernandez, Eberly, Avolio, & Johnson, 2011; Spicker, 2012). A researcher noted that a gap in the literature exists and suggested future leadership researchers should include resource allocation processes in their studies of leadership (Spicker, 2012).

Changes in social, economic, and demographic factors affecting public higher education institutions. The Great Recession resulted in changed consumption patterns for higher education with a shift in demand that grew community college enrollment while public funding for community colleges fell (Jenkins & Rodriguez, 2013). HEIs adapted their behavior based on the dynamic changes in their external environment (Popara, 2013). Public colleges that increased student RG rates grew or maintained public funding and tuition revenue resulting in improved access to financial resources by some public colleges (Schuh & Gansemer-Topf, 2012). Additionally, changes in retention rates affected resource allocation decisions for minimum class size, degree offerings, staffing levels, and the adoption of new technology (Altundemir, 2013).

Beyond new competitive pressures, HEIs experienced increased enrollment as more high school graduates decided to attend college (Fusilier & Munro, 2013). The continued democratization of access to higher education supported the growth of institutions that promoted increased performance by disadvantaged groups (Dill & Beerkens, 2013). HEI administrators focused on outcome growth by managing variables within their control (Fernández et al., 2011).

Researchers using IPEDS data calculated the demand elasticity for community college courses related to changes in the unemployment rate (Hillman and Orians, 2013). Community college enrollment grew between 1.1% and 3.3% for each 1% increase in the unemployment rate (Hillman & Orians, 2013). Researchers documented that individuals make marginal decisions in attending community colleges based on their unemployment status (Hillman & Orians, 2013). Community college enrollments grew as local economic conditions declined (Hillman & Orians, 2013). Analysts who used an IPEDS data set without student demographic factors limited the generalizability of the conclusions (Hillman & Orians, 2013).

The percentage of new college students testing at pre-college levels of academic readiness grew to 60% by 2014 (NCES, 2014a). With the increased demand for remedial courses, colleges increased the number of remedial course sections and reduced the number of upper-level course sections (Bound, Lovenheim, & Turner, 2010). The result was that upper division students faced reduced access to required courses causing an institutional conflict between meeting the needs of successful students against the needs of academically underprepared matriculating students (Bound et al., 2010).

The changing economic conditions resulted in shifts in state budget allocations away from HEIs toward healthcare, K–12 schools, and prison systems (Brady, 2013). Researchers documented that academic quality fell with the increased commercialization of HEIs and public funding cuts (Brady, 2013). Moreover, increases state expenditures for Medicare and other social programs were beyond the control of the state governments and resulting in budgetary cuts in higher education and other discretionary accounts

(Harbour & Wolgemuth, 2013). Administrators at public HEIs focused on understanding the influence of changing funding patterns, and identified opportunities for maintaining quality while educating 75% of U.S. college students (Brady, 2013). HEIs required greater flexibility in responding to changes in their environments (Fusilier & Munro, 2013). In their study of Canadian higher education, Hannay, Jaafar, and Earl (2013) documented the use of innovation in adapting to changing regulatory and economic factors. The rapidly changing competitive environment introduced conflict between student and institutional goals (Moskal et al., 2013).

A literature review documented the shift in resource allocations at HEIs resulting from reduced public funding and increased accountability requirements (Travis, 2013). HEIs increased faculty workloads, reduced services, increased tuition costs, and adjusted the level of quality in the face of economic challenges (Travis, 2013). Adjusting resource allocations might have an adverse impact on underserved groups if administrators failed to operate efficiently and consider the special needs of their student populations (Travis, 2013). Regulators sought management approaches that included econometric and statistical analysis of performance outcomes (Cousins et al., 2014). Education administrators introduced cost-effectiveness approaches in their evaluation of institutional success (Cousins et al., 2014).

National trends in funding of public higher education institutions. Colleges compensated for falling public funding by increasing tuition and fees (Altundemir, 2013; Ehrenberg, 2012). By 2008, tuition and fees composed more than 40% of the revenue stream for public colleges and universities, a more than 70% increase in twenty years

(Altundemir, 2013). Institutions of higher education adjusted to tight operating budgets by increasing class sizes and expanding the use of adjunct faculty (Altundemir, 2013). Additionally, many states adjusted the organizational structure of their public colleges and universities resulting in efficiency gains and reduced overhead expenses (Altundemir, 2013).

A literature review documented the shifting financial burden from the state to the student by reduced public funding and increased student costs (Harbour & Wolgemuth, 2013). Changes in federal financial aid and the shifting of some scholarships from need-based to merit-based reduced access to higher education for marginalized groups (Harbour & Wolgemuth, 2013). Regulatory changes that reduced the availability of developmental course offerings negatively influenced outcomes for underprepared students (Harbour & Wolgemuth, 2013). In total, the shift toward merit-scholarships, increased tuition rates, reduced financial aid, and new restrictions on developmental courses stratified access to higher education by marginalizing the underprepared and lowest socioeconomic groups (Harbour & Wolgemuth, 2013).

Expanding access to higher education was a common mission for U. S. community colleges, and the shifting of costs to the student from the public sector reduced access to education for disadvantaged students (Bound et al., 2010; Jenkins & Rodriguez, 2013). Funding cuts at public colleges negatively influenced the ability of the institution to fulfill their missions (McNair et al., 2011). The increased reliance on tuition and fee revenue by colleges shifted the burden of higher education costs from the public sector to student households (Schuh & Gansemer-Topf, 2012).

Competition for limited public funds and other challenging economic factors multiplied the impact on a college associated with student decisions to leave the college (Tinto, 1982). HEIs faced tight budget cycles and the increased use of outcome metrics by the public (Tinto, 2012). As public funding declined, U.S. colleges and universities increased their reliance on tuition revenue (Schuh & Gansemer-Topf, 2012). Growing retention rates improved the institution's financial position (Beal & Pascarella, 1982). The loss of tuition revenue associated with student attrition impedes the financial operations of higher educational institutions by reducing the revenue stream (Schuh & Gansemer-Topf, 2012). Conservative public education budgets pressured colleges and universities to focus on student success metrics like retention as a means of improving accountability and generating revenue (Tinto, 2012).

Following the 2008 economic recession, Connecticut's public funding for community colleges decreased while enrollment grew (Hussey & Swinton, 2011). U.S. undergraduate enrollment grew by 38% between 1999 and 2010 (Gray, Vitak, Easton, & Ellison, 2013). Increased access to education did not improve graduation rates (Hussey & Swinton, 2011).

Colleges adapt their resource allocations in response to changing conditions (Cuillier & Stoffle, 2011). Decision-makers at HEI libraries considered opportunity costs and developed new revenue streams while reallocating resources due to budget cuts (Cuillier & Stoffle, 2011). Library administrators considered the financial implications of their decisions (Cuillier & Stoffle, 2011). During times of rapid change, successful organizations focused on their core mission and long-term stakeholder needs (Avery &

Bergsteiner, 2011). The global regulatory trend supported the use of objective, outcome-based public funding processes (Dill & Beerkens, 2013).

National trends in accountability for public higher education institutions. As public funding for public colleges and universities fell, state governments implemented new oversight regulations with accountability standards (Clotfelter, Ladd, Muschkin, & Vigdor, 2013; Hansen, 2013). The goal of the accountability initiatives was the improvement in operating efficiency by the educational institutions (D'Amico, Katsinas, & Friedel, 2012). Compliance with the new regulations required the reallocation of resources, including administrator's time toward the development of programs to meet the new standards (Hansen, 2013). The public including government agencies used graduation rates in judging the quality of a college's operating results leading to new accountability standards tied to public funding decisions (Tinto, 2012). Several state education oversight panels implemented policies aimed at reducing student enrollment in remedial coursework (Gabbard & Mupinga, 2013).

State regulators implemented additional outcome documentation and accountability standards by introducing outcome based public funding algorithms emphasizing retention rates as a key indicator of institutional quality (Berger & Lyon, 2005). Successful educational outcomes required the development of strong social relationships that grew motivation for achievement (Dutton, Roberts, & Bednar, 2011). Increased calls by regulators for quality improvements led to an increased reliance on RG metrics as proxy measurements of quality (Kahu, 2013).

Higher education accreditation standards shifted toward assessment of outcome metrics increasing institutional focus on retention, persistence, and graduation outcomes (Berger & Lyon, 2005). Administrators continued to shift their attention toward outcome metrics as competition for limited resources among public colleges and universities increased (Berger & Lyon, 2005). New course delivery options increased competition among HEIs for students and presented resource allocation decision-making challenges for college administrators (Altundemir, 2013). Often, HEIs reacted to new accountability standards by reallocating resources from academics to retention programs supported by the student services divisions (Ehrenberg, 2012).

Colleges adapted to new competitive public funding formulas and accountability standards by shifting their limited resources toward efforts that improve outcome metrics (Ehrenberg, 2012; Marginson, 2013). HEIs focused their attention on outcome metrics that might be influenced by institutional action such as class size, faculty ratios, and pass rates (Fernández et al., 2011). Researchers documented that student advising programs grew retention and supported student progress toward their degree (Fernández et al., 2011). Beyond increasing tuition and fees, institutions focused on their institution-level decision-making options that might influence funding metrics or customer satisfaction (Marginson, 2013). Policymakers focused on student outcomes especially graduation metrics because of the low graduation rate without investigating the causes of low RG metrics (Kolenovic, Linderman, Karp, & Mechur, 2013).

As administrators reallocated resources toward efforts that might increase output metrics, they failed in identifying negative externalities associated with changes in educational quality and access to higher education for disadvantaged sectors of the community (Jenkins & Rodriguez, 2013). Outcome metric decision-making processes failed to consider the potential disparate impact on underserved, disadvantaged population segments (Dougherty et al., 2013). Additionally, the rate of decline in public funding exceeded the rate of decline in graduation rates making it appear that college performance improved because the cost per degree awarded declined (Jenkins & Rodriguez, 2013).

Higher education systems in several countries adjusted their funding and accountability standards after the 2008 economic recession. Nigerian HEIs adapted to changes in student behavior including motivation and academic readiness by changing their funding patterns (Fagbohungbe, 2012). Political changes in the Netherlands resulted in increased reliance on performance outcomes in public higher education funding decisions (Enders, de Boer, & Weyer, 2013). The Netherlands introduced an incentive-based funding program for public colleges and universities resulting in institutions focused on target market decision-making (Enders et al., 2013).

The Eurozone bailout influenced the Irish higher education system by shifting away from public funding toward other revenue sources with an emphasis on balancing stakeholder needs (Lillis & Lynch, 2013). The Pakistani Commission of Higher Education's implementation of TQM standards included standardized best practices, increased transparency, and required quality assurance initiatives (Baig, Abrar, Ali, & Ahmad, 2015). A comparison of how nations responded to increased global competition for higher education documented that funding algorithms using outcome metrics resulted in lower academic quality as institutions adjusted their standards in an effort to grow the incentivized outcome metric (Dill & Beerkens, 2013). Researchers identified the existence of a gap in the research related to understanding the impact of public funding algorithms using student outcome metrics on academic quality and access to higher education (Dougherty et al., 2013).

Changes unique to Connecticut's public sector higher education environment. By 2012, Connecticut's public funding of higher educational services decreased while tuition and fee schedules increased in real terms from 2007 levels (Altundemir, 2012). In 2011, the Connecticut legislature passed An Act Concerning a Reorganization of Connecticut's System of Public Higher Education, Public Act 11-48 [PA11-48] that restructured the supervision of the state's 12 community colleges, 4 of the state universities, and the state online university under the supervision of the Board of Regents (BOR). PA11-48 gave the BOR control over the allocation of public funding across the 17 BOR institutions. Changes in reporting structures challenged the success of leaders in adapting to changing market conditions (Hannay, Jaafar, & Earl, 2013).

In 2012, the CT state legislature sought to control student and institutional costs associated with student placement in remedial, college-readiness courses through the passage of An Act Concerning College Readiness and Completion, Public Act 12-40 (PA12-40). PA12-40 reduced academic choice at the BOR institutions by mandating the reduction of remedial courses to a maximum of one course per subject area and required the embedding of the material inside college level courses. The colleges and universities may encourage student completion of developmental coursework without mandating completion of developmental courses (PA12-40, 2012). Approximately 60% of all undergraduate students at U.S. colleges and universities placed into at least one developmental course (NCES, 2014a). Remediation coursework along with new student orientation programs, early advising, and development of student-faculty relationships strategies were tools used by institutions for growing student RG outcomes (Gabbard & Mupinga, 2013).

The BOR established a strategic outlook emphasizing student throughput metrics including retention, persistence within the BOR institutions, and graduation rates (CSCU-BOR, 2013). The BOR tracks institutional results using the NCES reporting of FT-FT cohorts (CSCU-BOR, 2013). Under the new strategic initiative, the BOR is developing internal definitions for retention, progression, persistence, and graduation in an effort to capture the quality of outcomes within the BOR schools, supplementing the NCES definitions focused on per institution outcomes (K. Kaminski, personal communication, July 2, 2014).

The BOR's proposed addition of using the graduation rate metric in the new funding algorithm focused institutional decision-makers attention on graduation rates (K. Kaminski, personal communication, July 2, 2014). The presidents of the 17 BOR institutions expect the future funding allocations to be based on student outcome metrics including retention, progression, persistence, and graduation rates (K. Dennis, personal communication, September 26, 2013). An advantage of the environmental shifts is that changing environments loosen behavior patterns supporting innovative changes in individual behaviors and organizational outcomes (Brown & May, 2012).

Alignment of strategic goals for the CSCU system and the CSCU institutions is an ongoing process (K. Dennis, personal communication, November 5, 2013). Transform CSCU 2020 outlined the BOR's strategic vision for the 17 public institutions of higher education in the BOR system (CSCU-BOR, 2013). In support of the mission of access to education, the strategic commitments listed first-year success; growth in retention, persistence, and graduation rates; and the use of benchmark best practices for assessment and accountability (CSCU-BOR, 2013).

Cost containment features of the strategic process focused on the consolidation of services at the BOR level, naming centers of excellence that eliminated duplication of small programs across campuses, and improving transfer seamlessness between the community colleges and state universities (K. Dennis, personal communication, September 26, 2013). Student success, community relations, and institutional effectiveness are the three critical success priorities identified in the CCC'*s Strategic Plan 2010–2105* (2012). Effective planning, relationship building, and support for change processes improved leader effectiveness (DeRue, Nahrgang, Wellman, & Humphrey, 2011). The president of the CCC pledged to maintain transparency and engagement as the institution continues its transition to oversight by the BOR (K. Dennis, personal communication, September 26, 2013). Member institutions must balance the demands of underprepared students, needs of upperclassmen, and the community's need for a highly skilled workforce.

Use of Archival, Secondary Data

Secondary data sources include data collected for another purpose often in response to organizational needs or regulatory requirements. Primary data includes datum collected by the researcher for use in their study (Gelo at al., 2008). The collection and documentation of historical data does not involve the researcher and relies on outside individuals or agencies for data collection or documentation of past events (Gelo et al., 2008). An advantage of using secondary data from internal information systems is that the data already existed, eliminating time and money constraints from the research process (Alvarez, Canduela, & Raeside, 2012). The richness of secondary data sets reflected the quality of the design and data collection method used in developing the secondary data along with high response rates (Alvarez et al., 2012). Archival data sets permit backward–looking longitudinal studies of relationships (Greenhoot & Dowsett, 2012). Secondary data sets often include documented weights and distribution factors supporting analysis of differences or the levels of importance of the parameters (Alvarez et al., 2012).

Protecting the rights of participants who provided data for a research study is critically important. Compliance with the Belmont Report requires researchers to protect individuals from harm, treat participants with respect, and obtain informed consent (Brakewood & Poldrack, 2013). Secondary data sets with personal identifiers removed protected participants from disclosure reducing the possibility of future harm (Brakewood & Poldrack, 2013). The removal of all identifier information and other data security techniques complied with the Belmont Report standards (Brakewood & Poldrack, 2013).

A disadvantage of using data collected for another purpose is the possible mismatch between desired measurements and available measurements. Data interpretation difficulties resulted from the researcher's lack of influence over the data collection process such as variable and participant identification, scales, and excluded variables decision-making (Greenhoot & Dowsett, 2012). By employing secondary data sets, researchers eliminate the time and financial constraints related to the design, piloting, and deployment of a new data collection tool (Alvarez et al., 2012). In a literature review of leadership research, the authors noted the use of archival, secondary data in field studies in 23% of the published articles (Dinh et al., 2014).

In compliance with the Higher Education Act of 1965, as amended, institutions who receive federal funding report student cohort retention rates, graduation rates, staffing levels, and financial aid status to NCES (NCES, 2014b) for reporting in IPEDS. The IPEDS Data Center provides public access for analysis of institutional reports and national trends in higher education enrollment and outcome parameters (NCES, 2014b). The Student Right to Know Act of 1990 requires tracking and disclosure of student educational outcomes using standardized definitions. The use of existing data sources improved the quality of the analyzed data and improved the quality of the conclusions drawn by researchers (E. W. Carter et al., 2013). Gains in external validity resulted from quantitative analysis using data sets collected naturally, without the involvement of the researchers in the collection process (Aguinis & Edwards, 2014).

To comply with federal regulations, U.S. colleges and universities track student cohorts composed of first-time–full-time (FT-FT) students who begin their studies in the fall semester (Tinto, 2012). NCES' data understated attrition rates because of the lack of information regarding outcomes for part-time, transfer, swirling, and nonmatriculated students (Tinto, 2012). IPEDS data's nontracking of nontraditional students, or who entered in semesters other than the fall, or who returned to higher education after a lapse in attendance introduced generalizability issues into studies based on the data (Hagedorn, 2005).

Data sets may contain flaws related to questions asked, missing data points, or poor collection methods (Gelo et al., 2008). Student ethnicity traits were self-reported student information in the IPEDS Data Center public data set (T. Vice, personal communication, June 13, 2014). Researchers questioned the accuracy of self-reported student satisfaction information (Colbert, Judge, Choi, & Wang, 2012). Moreover, data collected in a natural setting may more accurately record participant actions without interference from the researcher (Gelo et al., 2008). Self-reported information might contain errors due to misunderstanding the question, lack of knowledge, error, or memory bias (Kahu, 2013). A study used self-reported placement in remedial courses because alternative variables did not provide complete information or resulted in other validity and reliability issues (Sparks & Malkus, 2013).

Researchers who studied changes in higher educational outcomes often used national databases including NCES and IPEDS data in their analysis. A statistical evaluation of student outcomes across California's public, community colleges for students placed in community college developmental courses primarily used IPEDS data (Bahr, 2012). The study supplemented the nationally reported parameters with additional student demographic information and differences in placement standards for developmental courses based on each community college's database (Bahr, 2012).

A study used IPEDS data in calculating the approximate 2% growth in community college enrollment for every 1% increase in the unemployment rate (Hillman & Orians, 2013). The NCES reported college graduation rate was a measure of institutional quality related to the North Carolina Community College System's mission of improving the skills of the community's workforce (Clotfelter et al., 2013). Another study used ANOVA statistical analysis in determining patterns of enrollment for public community college students using California IPEDS data (Bahr, 2013). IPEDS graduation rate data frequently served as a proxy for institution success (Bahr, 2013).

A linear regression analysis of student enrollment demand at community colleges used a data set developed from the IPEDS Data Center (Hillman & Orians, 2013). Additionally, IPEDS data informed a study of student enrollment patterns and the merit-based financial aid system in Florida (Zhang, Hu, & Sensenig, 2013). A possible problem associated with the IPEDS data is that California enrolled 25% of all U.S. community college students, possibly skewing the data set's information (Romano, 2012).

Social science researchers use institutionally collected and maintained databases in the evaluation of outcomes from strategic initiatives. An analysis of student engagement and educational outcomes, including persistence and grade point averages, used data from the intuition's database and student responses to two national student surveys (Hu & McCormick, 2012). The analysis of the correlation between financial aid award levels and student re-enrollment used IPEDS and the Beginning Postsecondary

Students survey (BPS96/01; Chen, 2012). Using a student survey and the institution's database, Gray et al. (2013) studied the relationship between first-year student assimilation to college and student use of social media. Alternatively, Lamb and Annetta (2013) used NCES data in documenting the probability of access to the Internet at home and student reported qualification for free or reduced-price lunches as a proxy for student socioeconomic status.

The documentation of national trends in high school-college dual enrollment retention trends was based on the analysis NCES data, a state database, and logistic regression (D'Amico, Morgan, Robertson, & Rivers, 2013). The absence of student demographic information particularly ethnicity limited the breadth of the analysis of factors influencing retention of formerly dual enrolled students (D'Amico et al., 2013). In another study, the data collection process gathered NCES reported data from the institution's database and supported the determination of the statistical importance of completing a library resource course on retention rates, graduation rates, and student grade point averages (Cook, 2104). Therefore, NCES, IPEDS, and institutional databases are reasonable sources for use in the analysis of student retention relationships.

Statistical Analysis Methodology

The application of mathematical modeling and statistical testing aids the researcher in the identification of relationships between predictor and criterion variables. Researchers align the research question, method, design, and analytical approach in an effort to maximize the quality of the researcher's conclusions (Gelo et al., 2008). Each analysis strategy results in different validity and reliability concerns, and researchers should limit their conclusions based on the limitations of their adopted strategy (Gelo at al., 2008). Researchers encourage the use of appropriate assumption-testing strategies by social science researchers in an effort to strengthen the quality of the research (Finch & French, 2013). Multivariate analysis supports the simultaneous analysis of attribute differences among a set of factors (Finch & French, 2013). Unmeasured confounding variables might influence the output of quantitative analysis (Monaghan & Attewell, 2015). Therefore, the chosen statistical analysis approach must match the types of available data, the research question(s), and the statistical tool.

Researchers frequently use inferential statistical analysis methods in evaluating the influence of independent variables on dependent variables especially when using small sample sizes. A literature review focused on the statistical approaches used in family business research noted the trend away from simple statistical methods toward more sophisticated modeling approaches (Wilson et al., 2014). ANOVA or MANOVA statistical tools were not used in this study because the outcome variable, retention was a categorical measurement. Regression analysis permits researcher led examination of relationships between multiple predictor variables and an output variable.

As a form of regression analysis, binary logistic regression computes the linear coefficients, β, for a combination of independent categorical or ratio predictor variables and a dichotomous, categorical criterion variable (Genest, Nikoloulopoulos, Rivest, & Fortin, 2013). Binary logistic regression investigates the odds that changes in predictor variables will result in changes in the criterion variable (Lamb & Annetta, 2013).

Researchers using hierarchical logistic regression specify the order of variable entry with the change in variance assigned to each variable in order of entry (French, Immekus, & Yen, 2013). Using the hierarchical logistic regression methodology permitted the refinement of the analysis of covariance between predictor variables by assigning the variance intersection to the first entered variable and using control variables (French et al., 2013). The final statistical models included independent variables that were at least marginally important in explaining the model's variance (Bien & Tibshirani, 2013). In focusing on meaningful variables, the reduced number of included variables complies with a goal of variable sparsity (Bien & Tibshirani, 2013). Using hierarchical logistic regression in a study of engineering student retention, the researchers entered the independent variables based on time of occurrence with demographic variables entered before academic performance variables and used GPA as a control variable (French et al., 2005). Both cognitive and noncognitive attributes were statistically related to a student's second to third year retention decision among engineering majors in an analysis that used a hierarchical logistic regression approach (Morrow & Ackermann, 2012).

The assumptions associated with parametric regression models include linearity of the relationship, error independence, normal distributions, and equal variance (Berenson, 2013). The investigation of relationships using data that does not conform to the parametric assumptions requires the use of nonparametric statistical modeling techniques (Derrac, García, Molina, & Herrera, 2011). Binary logistic regression considers a categorical criterion with possibly multiple scales of predictor variables eliminating many of the assumptions found in regression analysis. Users of binary logistic regression assume a well-defined model using a logarithmic linear relationship between independent predictor variables and a criterion variable (Tonidandel & LeBreton, 2010). The predictor variables are assumed to have nonlinear relationships with each other so that two predictor variables do not measure the same construct (Tonidandel & LeBreton, 2010). It is important to test variable assumptions before using binary logistic regression (Genest et al., 2013).

Quantitative methods provide a foundation for hypothesis testing (Gelo et al., 2008) Power, a measurement of statistical strength, refers to the probability of rejecting a false null hypothesis when the null hypothesis was false, a Type II error (Tillman et al., 2011). Sufficient power suggests that sample size was sufficiently large for the statistical analysis (Tillman et al., 2011). One of the advantages of using *p*-values was the examination of the strength of the statistical significance in place of a predetermined Type I error, α, level of significance (Derrac et al., 2011).

An outcome from binary logistic regression is an understanding of which predictor variables account for the largest percentage of the criterion variable's variance (Tonidandel & LeBreton, 2011). Delta R^2 or delta log odds ratio measured effect size (Hidalgo, Gómez-Benito, & Zumbo, 2014). Determining the collinearity and multicollinearity relationships between predictor variables assists researchers in identifying the importance of each predictor variable in the regression model (Braun & Oswald, 2011; Genest et al., 2013; Tonidandel & LeBreton, 2011). Regression analysis does not determine relationships between variables and recommended additional statistical tool development and analysis (Clotfelter et al., 2013). If variables are collinear then alternative measures including relative weights whose sum equal R^2 indicated the percentage of criterion variance explained by each predictor variable (Tonidandel & LeBreton, 2011). Researchers should understand the unique and common relationships between predictor variables in choosing the predictor variables for inclusion in the regression model (Ray-Mukherjee et al., 2014). Partitioning individually and by variable sets aided in determining the percentage of the criterion variable explained by each predictor variable and any interrelationship between predictor variables (Ray-Mukherjee et al., 2014).

Generalizability of results, development of benchmarked practices, and comparison of outcomes across studies require common analytical formats that were often missing in educational research (Bowman, 2012). Decision-makers need sufficient information before conducting a meaningful interpretation of quantifiable data sets (Tinto, 2012). In a study of the influence of online learning modules on student outcomes, mean-weighting computations adjusted for differences in sample sizes and composition to clarify the relationships between the variables, including student demographic factors (Lamb & Annetta, 2013). ANOVA analysis proved useful in the identification of relationships between clusters of independent variables while investigating community college enrollment patterns (Bahr, 2013). Frequently, organizational scholars used MANOVA in evaluating numerical data sets with multiple dependent variables providing insights into the relationship between the dependent variables (Tonidandel & LeBreton, 2013). Analysts used logistic regression analysis in the study of community college graduation rates (Kolenovic et al., 2013).

Variable Determination

The strength of the conclusions based on statistical analysis depends on the inclusion of appropriate variables and consideration of possible confounding variables. Individual or groups of confounding variables and the inability to control all variables influenced the generalizability of the researcher's conclusions (Gelo et al., 2008). This study included the longitudinal, correlational analysis of the level of statistical significance in the relationship between student demographic variables, NSAR completion, academic outcomes, and retention.

Student demographic variables. The analysis of differences in student outcomes between students considered differences between the students, including life experiences before attending college (Kolenovic et al., 2013). In the analysis of differences in retention rates researchers noted the importance of documenting attribute differences between groups of students (Tinto, 1982). Key attributes included race, gender, socioeconomic group, and documented academic ability (Tinto, 1982).

In an expansion of the study of control variables in college retention evaluation, the separation of attributes into classes such as demographics, academics, motivation, personality, and institutional factors enhanced the depth of the analysis (Lenning, 1982). Within the category of student demographics, Lenning added age, ethnicity, and marital status. Differences in academic preparedness and motivation including study habits, high school grades, intensity of high school coursework, college major, and college grades also contributed to the difference in college outcomes (Lenning, 1982).

Additional student attributes included the identification of educational opportunities and accomplishments (Tinto, 1993). Building on Tinto's work, Hartley (2013) computed the statistical relationship between student attributes and academic outcomes, including credit completion and GPA. The additional variables included student attributes of high school GPA, standardized admissions exam scores, work status, sex, race, age, and mental health status (Hartley, 2013).

Students with undeclared majors or unclear career aspirations were more likely to struggle in college (Tinto, 2012). Standardized testing using Accuplacer knowledge exams with a single cut-off score resulted in inaccurate remediation placements for students just above or below the cut-off score (Bettinger et al., 2013). In a study of Texas education cost functions, researchers noted that student educational outcomes reflected past educational experience, student and family motivational factors, and community funding contributions (Gronberg, Jansen, & Taylor, 2011).

Additional student attributes that influence student educational outcomes included socioeconomic level, English fluency, and the mother's level of education (Clune 2002). Family size, family and public investment in the student's education, and single parent household attributes influenced student retention outcomes (Grissmer, 2002). The list of influential student attributes that affected re-enrollment decisions included prior social and academic preparedness, academic goals, and knowledge of higher education associated with the family's prior experiences in higher education (Tinto, 2012). A student's level of exposure to the institution's norms influenced student outcomes (Berger & Lyon, 2005). Patterns of school attendance indicated student commitment to their education (Grubb & Allen, 2011). In analyzing the effectiveness of a first-year-experience process, 19 student attributes focused on retention decisions and other student decisions (Clark & Cundiff, 2011).

Researchers continued to refine the list of student attributes that influenced retention, and noted the importance of student and college enthusiasm on retention decisions (Tinto, 2012). A student's financial aid status, full- or part-time enrollment status, and pattern of continuous enrollment influenced student retention, persistence, and graduation outcomes (Tinto, 2012). Differences in student life-loads associated with family, work, and community commitments influenced re-enrollment decisions (Kahu, 2013). First-generation college students often lacked family support and clear expectations about college requirements that influenced the student's academic and social success in college (Gray et al., 2013). Additionally, engagement with college staff, faculty, and student peers mitigated some of the negative factors affecting first-generation status on college retention (Kahu 2013).

Researchers evaluating retention outcomes considered the use of control variables in their studies. The use of a control set of variables mitigated the affects of academic and social development and career goals (Beal & Pascarella, 1982). Variables used by researchers in a study of the differences in student outcomes associated with voluntary participation in a first-year experience program included advising, first-generation status, athletic team participation, and student interest (Clark & Cundiff, 2011). A statistical analysis of covariates indicated that the student's high school grades and standardized test scores did not influence the outcomes (Clark & Cundiff, 2011). A gap in the research existed because researchers limited their focus to first-year retention rates without considering long-term consequences on graduation rates or the possible influence of first-year experience section composition such as the assigned faculty member or the academic and social preparedness of peers (Clark & Cundiff, 2011).

Bahr (2012) studied the academic retention, persistence, and graduation patterns for students enrolled in developmental courses. The student's level of preparedness for college–level work influenced student academic outcomes (Bahr, 2012). Students required to complete several levels of development courses were more likely to not complete a college credential than students who entered college academically prepared (Bahr, 2012; Tinto, 2013). Bahr was surprised by the finding that female students and students with heavier course loads persisted at a relatively greater rate than other developmental students.

In a study of the elasticity of community college enrollment and community unemployment rates, the reduced generalizability of the findings related to the absence of student demographic information regarding age, gender, and race that might have influenced enrollment decisions (Hillman & Orians, 2013). Within-student estimation identified possible self-selection bias related to change in family income or motivation to purchase a computer in determining the influence of broadband Internet access on student standardized test scores (Vigdor, Ladd, & Martinez, 2014). Student demographic attributes existed before the student enrolls in college and do not change because of college enrollment.

In this study, student demographic variables included enrollment year, age, race or ethnicity, gender, socioeconomic group, and academic readiness because they are part of the institution's database. Socioeconomic group quantified a student's financial aid award status. Each student's academic readiness for college indicated the student's registration or nonregistration in developmental mathematics or English courses in their first semester. The institutional data set did not include information on possible confounding variables including the student's family history within higher education, household degree attainment, high school GPA or course level, and the student's motivation to complete a degree program.

New student advising and registration (NSAR). A voluntary program, NSAR assists students as they take their placement assessments, explore alternative courses of study, and register for the student's first semester courses (CCC Attend New Student Advising and Registration [NSAR] Session, n.d.). The CCC implemented NSAR with the goal of growing the student outcome metrics including retention, progression, and graduation rates (R. Boune, personal communication, January 18, 2014). NSAR, a college transition support initiative, provides matriculated students with a half-day emersion experience with placement testing, advising, registration, and interaction with faculty, staff, and successful peers (R. Boune, personal communication, January 18, 2014). The designers of NSAR focused on Tinto's paradigm for growing student retention by fostering first-semester classroom success and engagement with the campus community (B. Johnson, personal communication, November 25, 2013). RG strategies could improve student outcomes (Saltzman & Roeder, 2012). The absence of accurate and effective academic advising related to student dissatisfaction with their college experience (DeShields et al., 2005). Therefore, academic advising plays an important role in a student's first-year experience.

Academic outcome variables. The relationship between student progression toward a degree and retention rates played an important role in the discussion of institutional success (Tinto, 2013). Interactionist theory suggested that students reach re-enrollment decisions based partially on their recent academic experiences (Tinto, 2012). The effectiveness of the academic advising experience influences a student's affiliation with the institution, and impacts student's course performance, course completion, and grade point average (Tinto, 2012). Students with higher GPAs, a higher level of academic success, were more likely to re-enroll at the same institution of higher education (Tinto, 2012). There was a positive correlation between persistence decisions and the individual's expectancy and valence measurements determined by individual judgment of past events and potential future outcomes (Holland, 2011). Positive student experiences correlated with increased student satisfaction with their academic progress and probably influenced student retention decisions (DeShields et al., 2005). In a study of students with mental health conditions, a researcher investigated the statistical relationship between student demographic attributes with credits earned and GPA (Hartley, 2013).

Policy changes in Connecticut might influence student outcomes. Connecticut Public Act 12-40 (2012) mandated changes in developmental education across the state's public higher education system. The implementation of regulations limiting access to developmental course work negatively affected the academic outcomes for underprepared students (Harbour & Wolgemuth, 2013). The compression of multiple tiers of developmental course sequences into a single course or embedded competencies in a college level course might negatively impact student success by altering the pace and quality of course content delivery. Poor academic outcomes include slow credit completion rates and low GPAs.

This study's data set included FT-FT students enrolled in a minimum of 12 credits per semester. The expected normal total credits earned was 24 for the student's first academic year. The total credits earned variable indicated the student's academic success in completing attempted courses. The student's GPA indicated the level of academic performance during the student's first academic semester.

Retention. A student's decision to re-enroll at a college is a function of their college experiences, preparation for college, and other factors (Tinto, 2012). A retained student is a member of the fall FT-FT cohort that re-enrolls for the next fall semester (NCES, 2014b). Colleges focus on student retention because federal reporting requirements track and report first-year student retention (Tinto, 2013). The goal of most students enrolled at community colleges was something other than earning an Associate's degree (Berger & Lyon, 2005). Administrators who focused on student satisfaction grew student retention and improved tuition-based institutional funding (DeShields et al., 2005). Decision-makers must balance the conflicting desires of the institution to improve measurable student outcomes including RG rates, and individual student academic goals that often do not include degree completion.

The increasing financial burden of attending college contributed to the lengthening of time to complete the college credential (Bound et al., 2012). The student RG factors of engagement, advising, campus culture, and use of support networks influenced the over 60% attrition rate for Black males in U.S. HEIs (Strayhorn, 2013). Student progress toward degree completion requires early coursework success (Tinto, 2013). Student advising programs that provide entering students with course selection and degree selection support improve student RG outcomes (Tinto, 2013).

This study included a student's retention choice as the criterion variable. The statistical analysis did not use graduation information because of the limited available data. The institutional data set included 150% graduation rates for only the initial NSAR year of fall 2011. The test of the hypothesized influence of an implemented strategic initiative on student outcomes evaluated the longitudinal statistical relationship between enrollment year, age, ethnicity, gender, socioeconomic group, academic readiness, NSAR completion, number of credits earned, GPA, and retention.

Financial Analysis Methodology

Evaluating the financial outcomes of alternative projects requires careful identification of the revenues and expenses associated with different outcomes and the use of a comparison model in determining resource allocations that optimize a college's financial results. Researchers determine that observation and measurement tools failed in directly determining the efficiency of resource allocation outcomes (Duncombe & Yinger, 2011). A value-added approach indicates changes in outcomes related to changes in variables within the organization's control (Duncombe & Yinger, 2011; Gronberg et al., 2011). Public regulators often evaluated college effectiveness using cost-effectiveness or value-added approaches (Cousins et al., 2014).

Cost-benefit analysis (CBA). The description of CBA includes the evaluation of alternative projects or project outcomes using the difference between a project's total monetary benefits and total monetary costs with opportunity costs (Levin & McEwan, 2002). Decision-makers order alternatives based on the absolute differences in their CBA (Levin & McEwan, 2002). CBA's ranking of projects based on the dollar differences in benefits over costs provides the best alternative evaluation process for program options with different outcomes (Levin & McEwan, 2002). The analyst's ability to compare processes with different combinations of goals and costs made CBA superior to cost-effectiveness analysis and other ranking systems (Levin & McEwan, 2002).

CBA computations require associating a dollar amount with each cost and benefit (Levin & McEwan, 2002). Researchers using CBA in comparing outcomes over time or assuming causal relationships should be cautious because of the differences associated with socioeconomic factors, resource availability, and student demographics (Levin & McEwan, 2002). Additionally, the use of standardized cost factors for wages, capital, and building costs across projects enhances the comparability between projects based on the present value CBA projections (Levin & McEwan, 2002).

Ranking projects by the CBA's calculated costs divided by benefits is a method for comparing projects of dissimilar size (Levin & McEwan, 2002). Analysts that calculated the monetized costs and benefits using present value discounting improved the accuracy of the CBA rankings (Levin & McEwan, 2002). Inaccuracies associated with measuring benefits in monetary terms reduce the effectiveness of the CBA process (Levin & McEwan, 2002). Decision makers using CBA rankings might err because of the assumptions and methods chosen by the analysts in calculating the cost and value of benefits (Levin & McEwan, 2002). An additional problem involved CBA's focus on average and total costs and benefits in place of marginal analysis detailing the incremental benefits and costs of the last units of each project (Levin & McEwan, 2002). By focusing on marginal costs, the comparison of dissimilar sized projects becomes easier.

Students select HEIs based on the comparison of marginal benefits and marginal costs (Stange, 2012). A modified cost-benefit approach describes student decision-making processes (Oreopoulos & Petronijevic, 2013). Students failed in accurately predicting the true cost of college by overestimating the cost of debt and underestimating the wage premium associated with earning a postsecondary credential (Oreopoulos & Petronijevic, 2013). A simplified cost-benefit analysis of the financial benefits of college found the annual wage difference in the median wage for the degree minus the sum of the median wage for a high school diploma and the annual student loan repayment cost (Oreopoulos & Petronijevic, 2013). This approach failed to evaluate the opportunity cost of attending college, the wage premium for the years after the student loan repayments end, or convert future dollars to current dollars using present value analysis. Still, the simplified cost-benefit approach identified an annual wage gain significantly larger than the annual repayment amount for the student loans (Oreopoulos & Petronijevic, 2013).

Developing a dollar value for student outcomes associated with the completion of a college credential challenges program analysts (Chenhall, Hall, & Smith, 2013). Focusing on graduation rates without considering certificate completion rates underreports the success of community colleges in reaching their mission (Romano, 2012). The calculation of future expected income associated with alternative career and education pathways was difficult using secondary data sets (Hillman & Orians, 2013).

Accounting process choices influence the dollar computation in CBA analysis (Chenhall et al., 2013). Capital depreciation schedules and resource allocation reporting strategies influence the institution's financial reports (Chenhall et al., 2013). CBA and other computations that rely on financial reports would present decision-makers with different information under different accounting assumptions (Chenhall et al., 2013). The redesign of the institution's accounting system might improve the reporting of resource costs and allocation decisions providing consistent information for use in decision-making (Chenhall et al., 2013).

In the financial analysis of the Carolina Abecedarian Study of the early intervention educational support program, researchers considered the present value of the costs and benefits of the program for all stakeholders (Masse & Bernett, 2002). The measurement of costs and benefits across multiple generations required assumptions about economic growth, discount factors, and long-term changes in wages across generations (Masse & Bernett, 2002). Researchers hypothesized that CBA computations contributed to the evaluation process, and did not provide a complete evaluation of program efficiency (Masse & Bernett, 2002). Public benefits from the allocation of private and public funds might not be fully valued in the CBA computations (Masse & Bernett, 2002). Changes in social justice based on the reduction in the economic gap between socioeconomic groups should carry more weight than other costs and benefits associated with the Carolina Abecedarian Study (Masse & Bernett, 2002).

Cost-benefit analysis formed the computational basis for determining the influence of nonretention on an institution of higher education’s financial results (Schuh & Gansemer-Topf, 2012). The direct cost of a student dropping out of the college include the cost to recruit and assimilate the student and the replacement student determined as a per student cost present valued over the expected enrollment time required for earning the chosen college credential (Schuh & Gansemer-Topf, 2012). The college’s costs also include any financial aid provided by the institution (Schuh & Gansemer-Topf, 2012). Sources of lost revenue association with nonretention include the present value of foregone tuition, fees, and ancillary revenue including bookstore and cafeteria income (Schuh & Gansemer-Topf, 2012). Student retention decision-making aligned with CBA processes (Tinto, 2013).

Some of the cost and revenue streams extend many years beyond the anticipated graduation date (Schuh & Gansemer-Topf, 2012). Difficulty in monetizing the indirect costs of faculty time spent building relationships with students who later departed challenge the accuracy of the cost-benefit analysis (Schuh & Gansemer-Topf, 2012). Future institutional impacts included loss of financial and volunteer resources contributed by graduates (Schuh & Gansemer-Topf, 2012). Students who withdrew from the college did not refer their family and friends including future generations to the institutions thereby reducing the pool of potential students for the college (Schuh & Gansemer-Topf, 2012).

Researchers identified additional costs associated with the nonretention of a student until graduation (Schuh & Gansemer-Topf, 2012). Institutions planned their staffing levels based on anticipated enrollment rates, and decreases in the number of enrolled students particularly beyond the first-year resulted in increased labor costs per student for upper-level courses (Schuh & Gansemer-Topf, 2012). The failure to retain upper division students caused the reduction in course offerings and eliminated degree programs (Schuh & Gansemer-Topf, 2012). Administrators managed their cost structure resulting in the loss of additional new and continuing students interested in the eliminated courses (Schuh & Gansemer-Topf, 2012). Some expenses remained relatively stable over time such as building operating costs, career placement, and library costs even as upper-class enrollment rates declined (Schuh & Gansemer-Topf, 2012). Possible revenue sources resulting from increased retention rates include tuition, fees, and growth in public funding resulting from improvements in the institution's outcome metrics (Schuh & Gansemer-Topf, 2012).

Cost-effectiveness analysis (CEA). An alternative to CBA, cost-effectiveness analysis (CEA) permits the ranking of alternative projects based on the cost per unit of change in outcomes (Levin & McEwan, 2002). CEA analysts compute project costs over time using the same strategy as CBA by adding the value of all resources (Levin & McEwan, 2002). Listed cost factors included personnel costs with benefits for employees, consultants, and volunteers; amortized facilities and equipment costs with variable costs;

and participant costs including tuition, course materials, transportation, and opportunity costs (Levin & McEwan, 2002). Challenges faced in quantifying abstract or intangible outcomes from education included civic awareness and tolerance of diversity (Grubb & Allen, 2011).

The use of CEA overcame the difficulty identified in CBA's requirement for measuring all costs and benefits in monetary terms (Levin & McEwan, 2002). CBA ignored nonmonetary costs and benefits possibly skewing the favorability rankings of alternative projects (Levin & McEwan, 2002). If the alternative projects related to changes in the same measurable outcome goal, CEA's use of the stated desired outcome such as improvement in student metrics eliminated the need to quantify difficult to measure benefit parameters (Levin & McEwan, 2002). More over, the decision-maker's needs and wants often conflicted with equity goals and social change outcomes identified through consideration of the impact of a program on all stakeholders (Reynolds, 2014).

CEA analysts measures the cost effectiveness of programs designed for attaining the desired outcome (Levin & McEwan, 2002). CBA permits the comparison of projects with different inputs and outputs, and CEA required the use of the same quantifiable output parameter in comparing projects (Levin & McEwan, 2002). A flaw in both CBA and CEA computations is their reliance on total values rather than marginal values in determining the costs for changing units of outputs (Levin & McEwan, 2002). In evaluating a college initiative using CEA, the division of total costs by the change in the desired outcome yielded the cost of changing the college's effectiveness one unit as measured by the outcome parameter (Levin & McEwan, 2002). .

The usefulness of CEA computations improved by adding sensitivity analysis using Monte Carlo analysis with probabilities assigned to alternative cost and effectiveness streams improving the usefulness of the rankings of alternative projects developed using CBA or CEA (Levin & McEwan, 2002). A review of the literature included few articles employing CEA analysis or mention of cost considerations in educational settings (Rice, 2002). CEA rankings supported resource allocation decision-making among mutually exclusive policy options (Rice, 2002).

The use of CEA analysis effectively added resource accountability considerations into the resource allocation decision process (Rice, 2002). The increasing pressure for public accountability resulted in some administrators at public HEIs adopting improved decision-making processes (Rice, 2002). A continuing difficulty with the CEA metric is the reliance on a single measurement of outcome effectiveness that ignores benefits for some stakeholders (Rice, 2002). The CEA method is superior to CBA in evaluating outcomes associated with difficult to monetize operational changes (Levin & McEwan, 2002).

In an application of valuing policy changes in a college setting, researchers evaluated the changes in the Pakistani higher education system associated with the introduction of TQM processes (Asif, Awan, Khan, & Ahmad, 2013). Stakeholders included the institution and its employees, students and their families, the local community, businesses, accreditation boards, and the public sector (Asif et al., 2013). Decision makers attempted to balance the competing needs of all stakeholder groups at the macro and micro levels (Asif et al., 2013). In the end, difficulties with accurately measuring customer satisfaction and employee contributions impeded the analysis of TQM effectiveness (Asif et al., 2013).

Implications of Associate's Degree Attainment

Researchers identified economic and social gains associated with completing a college credential that accrue to the student, their family, local community stakeholders, the college, or the government.

Impact of college graduation on students and their families. Researchers documented the pecuniary and nonpecuniary costs and benefits of completing a college degree (Cope & Hannah, 1975). While completing college courses, students incurred direct financial costs including tuition, fees, transportation, and supplies expenses (Cope & Hannah, 1975). Nondirect costs include the opportunity cost of forgone activities while completing college such as lost earnings (Cope & Hannah, 1975). Not completing a higher education degree imposes financial costs such as reductions in earnings potential, and nonfinancial cost related to the psychological influence of dropping out of college including personal, familial, and peer group disappointment (Cope & Hannah, 1975). Individuals who completed a higher education degree tend to have better job prospects, better working conditions, greater job satisfaction, and improved job security (Cope & Hannah, 1975). Additionally, optimism about their personal and societal outlooks improved with the completion of a college degree (Cope & Hannah, 1975).

Tinto (2012) discussed the gains from career exploration. College courses provided students with an opportunity to take a variety of courses covering a wide assortment of content areas (Tinto, 2012). Students who took a variety of courses identified their relative strengths, weaknesses, interests, and dislikes about alternative career paths (Tinto, 2012).

Following Tinto's line of inquiry, researchers determined that higher education coursework provides students with gains in life skills, social skills, and enhanced abilities in working autonomously and on teams (Gray et al., 2013). The awareness of society's expectations regarding ethical behavior increased with an individual's higher education (Gray et al., 2013). College attendance enhanced the student's analytical skills including identification of root causes and the application of acquired knowledge in new situations (Laver, 2013).

A longitudinal study of early intervention education processes in the Carolina Abecedarian study documented the extensive long-term benefits of education on the student and their family (Masse & Bernett, 2002). Students who received the treatment of early and continual access to quality educational services demonstrated improved academic performance with higher course grades and the treatment group required fewer support services (Masse & Bernett, 2002). Positive social outcomes for the treatment group in the Carolina Abecedarian study included larger first- and second-generation family incomes, decreased reliance on social service networks, lower rates of incarceration, and improved self-esteem levels (Masse & Bernett, 2002). Individuals with college degrees committed fewer criminal acts (Grissmer, 2002). Additional years of education increased potential future earnings and eliminated public and private costs related to incarceration (Levin & McEwan, 2002).

Individuals with college credentials had a larger probability of being employed (Schuh & Gansemer-Topf, 2012). In June 2014, the unemployment rate among individuals with a Bachelor's degree was approximately two-thirds the rate for individuals with an Associate's degree (U.S. Bureau of Labor Statistics [BLS], 2014a). Individuals with some college or an Associate's degree were approximately 10% less likely to be unemployed in June 2014 than individuals with a high school diploma (BLS, 2014a). The unemployment rate for adults with some college or an Associate's degree was 5.1% versus 8.2% for the civilian U.S. population (BLS, 2014a).

Significant differences in lifetime earning potential resulted from earning a college degree or certificate. Wage gains from earning a college degree were largest for households at the lowest economic level because the college education eliminated the family's reliance on extremely low-wage jobs (Brand & Xie, 2010). The measured wage differential for an Associate's degree was approximately 13% over a worker's lifetime (Belfield & Bailey, 2011). Additionally, the annual, real, wage premium for an Associate's degree was about $9,600 for women and $6,000 for men (Jepsen Troske, & Coomes, 2014). The first quarter 2014 weekly wage gain for some college or an Associate's degree was 15% over workers with a high school diploma (BLS, 2014b).

Completion of a community college certificate program without earning an Associate's degree created a real annual increase in wages of approximately $1,200 (Jepsen et al., 2014). A female with an Associate's degree earned approximately 56% more in lifetime earnings than females with a high school diploma (Jepsen et al., 2014). Each additional year of college completion without attaining a degree or certificate yielded a wage increase of between 7 and 15% (Oreopoulos & Petronijevic, 2013). Completion of a college degree improved the student's employment outlook, increased lifetime earnings potential, and grew the student's situational power in the community (Hansen, 2013). There was a potential increase in a student's economic power associated with the completion of a college credential (Kolenovic et al., 2013).

Beyond changes in income levels, individuals with a college degree lived healthier lifestyles. Individuals who completed pre-baccalaureate courses had more stable employment histories in career positions, and shorter periods of unemployment especially for students from disadvantaged groups (Grubb, 2002a). Each additional year of higher education reduced the incidence of criminal activity, heavy drinking, obesity, and smoking (Belfield & Bailey, 2011). The noted reduction in risk-taking action resulted in health gains and increased use of preventive healthcare (Belfield & Bailey, 2011).

The nonpecuniary gains correlated with the completion of additional years of education included greater job satisfaction, additional fringe benefits, reductions in teen pregnancy, reduced criminal activity higher level critical thinking, and enhanced social skills (Oreopoulos & Salvanes, 2011). Critical thinking skills develop decision-making platforms when faced with new circumstances (Oreopoulos & Salvanes, 2011). Gains in social skills resulted in improved communication capacity, and greater ethical awareness (Oreopoulos & Salvanes, 2011). Additional years of education correlated with more stable marriages and improved health (Oreopoulos & Salvanes, 2011). Additional completed years of education built the student's level of trust resulting in greater social awareness and community involvement (Oreopoulos & Salvanes, 2011).

Gains for family members of individuals with a college credential extend beyond the influence of larger incomes and more stable employment. Children living in a household with a college-credentialed parent were more likely to perform at a higher academic level in school and complete college (Zhan & Sherraden, 2011). The largest gain occurred when the mother had a college degree (Zhan & Sherraden, 2011). Children with more educated parents made healthier choices, performed better in school, and had more success over their lifetime (Oreopoulos & Salvanes, 2011). In addition to the student and their family, local stakeholders including employers experienced gains when students completed college degree and certificate programs.

Impact of graduation rate gains on the local community. Macroeconomic activity expands as the labor force's knowledge, skills, and abilities grow. The gains from an individual's attainment of a postsecondary credential spill over from the individual to society (Levin & McEwan, 2002). In the E.U., college credentialed employees increase business productivity, innovation rates, and entrepreneurial outcomes (Millan, Congregado, Roman, van Praag, & van Stel, 2014). Improved labor skill sets result in businesses maintaining or growing their position in competitive markets (Carruth & Carruth, 2013).

Local stakeholders rely on community colleges for developing high school prepared students into a highly trained and qualified workforce (Gabbard & Mupinga, 2013). HEIs expand the skills and knowledge of the local labor force (Hansen, 2013). Employees who participated in training programs developed new skills and improved organizational outcomes (Truitt, 2011). Businesses pushed for growth in graduation rates because of their need for a pool of qualified workers (D'Amico et al., 2012). Educated citizens were more tolerant and contributed more hours as volunteers supporting community needs at a higher skill level (Brady, 2013).

The growth in market demand for educated and trained laborers expands the wage differential earned by college-credentialed workers (Zhan & Sherraden, 2011). A college-educated workforce improved the community through the cumulative gains in intellectual knowledge associated with interactions between faculty and student peers (Laver, 2013). Communities with more college–educated consumers experienced shifts in demand for products and services resulting from more informed consumption decisions (Millan et al., 2014).

Impact of graduation rate gains on local and state governments. Beyond the positive impacts on families and the local community, the state's financial position shifted as more students completed college degrees. Individual income gains generated increased state tax revenue (Kolenovic et al., 2013). Beyond revenue gains, crime rates fell as educational attainment increased permitting the shifting of resources previously allocated for the criminal justice system to education and other departments (Kolenovic et al., 2013). The reduced dependence on social welfare networks reduced government expenses for benefits (Kolenovic et al., 2013). Additionally, reductions in the need for social welfare resulted in reduced costs for welfare programs such as healthcare costs associated with limited use of preventive medicine and increased risk-taking activities (Belfield & Bailey, 2011).

States tended to shift the savings associated with reduced costs for healthcare, welfare, and criminal justice programs to increased funding for higher education (Brady, 2013). The additional funding for higher educations results in enhanced learning opportunities for the next generation of students (Brady, 2013). Higher levels of educational attainment especially obtaining a college credential develop a population with greater tolerance for individual differences, higher skill levels, and greater awareness of how society functions including political and economic knowledge (Brady, 2013).

Impact of retention and graduation rate gains on the community college. Institutional practices that grew retention and graduation rates reduced the college's operating costs and improved the institution's public image (Cope & Hannah, 1975). Costs associated with low RG rates included lost tuition and fees, reductions in teaching enthusiasm, additional expenses for recruiting and selecting replacement students, and increased record maintenance costs (Cope & Hannah, 1975). A college's lost financial resources included student support costs such as counseling, student scholarships or loans, and work-study training expenses (Cope & Hannah, 1975). Colleges and universities also incurred additional faculty expenses when faculty advised and built relationships with students who did not persist at the institution (Schuh & Gansemer-Topf, 2012).

The costs associated with student turnover challenge institutional financial results especially during periods of funding cuts for public colleges and universities (Tinto, 1982). Institutions incur significant search costs in attracting and selecting replacement students (Tinto, 2012). Without enough students re-enrolling or the addition of enough transfer students, the decreased enrollment in upper-level courses forces the elimination of degree programs or reduces the frequency of course offerings (Tinto, 2012).

The potential lost productivity associated with reductions in student counts and flat faculty counts includes reductions in class sizes, eliminated class sections, and smaller advising loads at a fixed cost of faculty labor (Schuh & Gansemer-Topf, 2012). A growth in student retention rates increases institutional income and reduced transfer student search expenses (Tinto, 2012). Researchers use CBA of student retention processes in confirming the significant loss in tuition, fee, and ancillary revenue associated with nonretention of students from the first to second year of study (Schuh & Gansemer-Topf, 2012).

The failure to complete a degree at the institution results in decreased positive word-of-mouth, falling institutional credibility, and reduced future donations to the institution's alumni fund (Cope & Hannah, 1975). Institutional development programs lagged when students failed to re-enroll or complete a degree program (Cope & Hannah, 1975). In the long term, the failure of a student to graduate cost the institution future donations of capital and volunteerism to university programs, and reductions in the number of referrals of siblings, family members, and friends across several decades (Schuh & Gansemer-Topf, 2012).

Summary of the Review of the Professional and Academic Literature

The review of the literature highlighted the importance of quantitative information in the decision-making process. Higher education administrators face new accountability standards, changing funding processes, and tighter operating budgets. The use of a quantitative, correlational design using hierarchical logistic regression statistical analysis supports the evaluation of the relationship between student attributes and retention. Researchers using CBA and CEA measured changes in institutional results based on an evaluation of the revenues and expenses associated with alternative initiatives. Tinto's theory of student retention decision-making provided a foundation for identifying stakeholder outcomes. The literature review considered individual decision-making based on Vroom's weighted anticipated outcomes and the value of outcomes to diverse stakeholders considered in values-engaged evaluation.

Transition and Summary

Executive decision-makers use information in drawing conclusions regarding resource allocation decision-making. During tight fiscal periods, community college administrators shifted funding away from academics toward student support service areas. By using a quantitative, correlational design, statistical analysis using hierarchical logistic regression, and financial analysis using CEA and CBA, of NSAR's financial impact might indicate the effectiveness of the allocated resources and better inform future decision-makers.

In Section 2, deeper exploration of the study method, data set, and statistical tools further develops the understanding of the relationship between student attributes, NSAR completion, academic outcomes, and retention on the college's financial sustainability. Further discussion of the use of financial analysis using CBA and CEA computations links the relationship between the CCC's implemented initiative's financial outcomes and the information needs of decision-makers. Section 3 documents the statistical analysis and the conclusions along with a discussion of the implications for business practice and social change.

Section 2: The Project

Connecticut's community colleges face a shifting environment with changes in oversight structure, declining public funding allocations, increased reliance on tuition and fees, and pressure for public accountability of educational outcomes. The Connecticut community college (CCC) designed and implemented a New Student Advising and Registration (NSAR) process designed to increase student outcomes through the provision of academic advising and course selection support, an introduction to the college's expectations, and establishing peer relationships. Understanding the information needs of decision-makers, including the financial outcomes of past decisions, might inform future resource allocation decision-makers resulting in improved institutional financial sustainability.

Purpose Statement

The purpose of this quantitative, correlational study was to inform college administrators about the relationship between the independent variables of student demographic factors, completion of NSAR, GPA, and the dependent variable of retention, and the effect on institutional financial sustainability. Financial sustainability was measured by values-engaged evaluation (VEE; Greene, 2013) with cost-benefit analysis (CBA; Levin & McEwan, 2002) and cost-effectiveness analysis (CEA; Grubb & Allen, 2011). The population for the study was the fall 2011-2013 NCES tracked first-time–full-time cohort (FT-FT) student cohorts at the CCC.

Student demographic variables include enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness (Tinto, 1982). Academic outcome variables include credits earned and GPA (Tinto, 2012). Changes in retention patterns affect organizational financial outcomes (DeShields et al., 2005). Resource allocation decision-making effectiveness might improve with a better understanding of the relationship between the strategy's costs, outcomes, and the college's financial results. The findings from this study might improve student educational outcomes leading to increases in society's labor productivity, income growth, and improved quality of life.

Role of the Researcher

The researcher plays a pivotal role in the design, analysis, and generalizability of the conclusions from a study to business practice. Researchers analyze the data after selecting the research method and design (Nimon, 2011). The choices in methodology, design, and analysis tools must align with the research question and the nature of the data along with the level of precision (Nimon, 2011). Additional key quality indicators for quantitative research include the use of independent, reliable data, and adoption of multiple tools for assumption testing.

The requested data for the study included archival information on members of the CCC's NCES 2011-2013 FT-FT fall cohorts and financial records. I requested copies of the structured data from the institution following the receipt of IRB-W 05-22-15-0388735 and IRB-C 5-13-15 approvals. The use of data collected in the normal course of business by the organization eliminated the need for a data collection instrument and improved the project's validity (Aguinis & Edwards, 2014).

Researchers must protect human data sources by fully complying with the Belmont Report's principles by practices supporting informed consent, participant respect, and minimizing harm (Brakewood & Poldrack, 2013). The CCC collected the data for this study in the course of their business and did not require informed consent. The data set for the study did not include any personal identifier information. The removal of all identifier information and other data security techniques complies with the Belmont Report (Brakewood & Poldrack, 2013). Anonymity within the data set protects the human data sources from harm and respects their privacy (Brakewood & Poldrack, 2013). The processes used in the study complied with the requirements of the IRB for Walden University and the CCC in conducting the data collection and analysis.

My job responsibilities brought me in contact with administrators, staff, and students involved with strategic initiatives. As a tenured, full professor of Business at the CCC, I had contact with members of the NCES FT-FT cohorts. My position responsibilities included academic and advising responsibilities, chairing of the CCC's Strategic Planning Committee, cochairing the assessment standard for the CCC's NEASC accreditation review, advising the Student Government Association, and leading the Center for Service-Learning. In June of 2014, I accepted the role of leader of the BOR Transform CSCU 2020 initiative on the strategic development of a first-year experience process across the system and a position on the BOR's Day of Service Committee. The committee work and proposals by the first-year experience occurred after the last data collection date for the secondary data on retention for this study.

As a student matriculates at the CCC, the student voluntarily decides to participate in NSAR that culminates before the start of the student's first academic semester. I had no contact with participants before their decision to attend NSAR. The research project does not include treatments with human participants. At all times, I endeavored to act in the student's best interest and maintain high ethical standards. My contact with FT-FT cohort students through teaching, student advising, and student government association advising occurred after the start of the student's first academic term and did not influence a student's decision to complete NSAR.

Additionally, beginning in the spring of 2014, I coordinated a new academic program designed to provide students with additional access to meaningful interactions with faculty, development of study skills, and improved knowledge of student support services. The study skills session offered in May of 2014 might have influenced the 2013 cohort's retention rate. Given the limited initial size of the review session rollout and the late in the academic year delivery, I suspect that any influence on the retention was negligible. My roles on campus remained the same except for the addition of the review program in May of 2014.

An optional program for newly enrolled students, New Student Orientation (NSO) connected students with student mentors, provided information on the expectations of the college, and highlighted available services. NSO programming occurred during the week immediately before the start of the semester and usually occurred after students registered for classes or completed NSAR. As an alternate faculty NSO presenter between 2011 and 2012, I presented at two NSO sessions and one transfer student NSO session. Each session included fewer than 50 new students with an undisclosed number of NCES FT-FT cohort students. The presentations included a brief overview of faculty expectations such as understanding a syllabus, preparation for class, and classroom etiquette. The standardized outline for the faculty presentation limited the influence of the presenter on a students' experience.

During the fall of 2011, I participated in several NSAR sessions designated for incoming students with declared Business Administration, Management, Accounting, Marketing, and Hospitality majors. I met with one or two students per session and followed NSAR protocols in discussing each student's educational goals, career plans, placement test results, and assisted in the selection and registration process for fall courses. The total one-on-one contact with students during NSAR sessions during the fall 2011 cohort's sessions did not exceed 10 students. Therefore, the limited direct interaction with NSAR participations might have a small impact on the retention outcomes for the 2011 FT-FT cohort of over 800 students.

Participants

The study's data set included attributes for the population of NCES fall FT-FT cohorts from 2011 through 2013 at a large, urban community college in Connecticut with personally identifiable student information removed. Each cohort consisted of around 850 newly matriculated students (T. Vice, personal communication, December 10, 2013). The students enrolled in college for the first-time as full-time students in the fall of 2011, 2012, or 2013 at the CCC. Frequently, researchers use NCES FT-FT cohorts in studies of retention and other educational outcomes (Hillman & Orians, 2013). New public funding algorithms for community colleges often include outcome metrics for the NCES tracked cohorts (Dougherty et al., 2013). U.S. law requires federally funded institutions such as institutions receiving federal student loans to report the retention, persistence, and graduation patterns for the FT-FT fall cohorts to the federal government (Tinto, 2012). In accordance with federal law, the CCC's Department of Institutional Research tracks and reports student demographics and performance indicators to the NCES.

The data set for the study included depersonalized, archival institutional data with values by FT-FT cohort member for each predictor and criterion variable. All NSAR sessions for the cohorts occurred before the beginning of this research project. I anticipated a limited number of incomplete student datum points resulting in the elimination of a few members of the FT-FT cohorts from the data set before conducting the statistical analysis. The inclusion of the entire population minus a few missing data points in the hypotheses testing eliminated the need for a sampling technique.

Research Method and Design

The three research methods of qualitative, quantitative, and mixed methods provide research platforms and standardized analysis protocols for answering different types of research questions (Gelo et al., 2008). The fundamental nature of the research question directs the selection of the research method (Tillman et al., 2011). Different research designs align with each research method (Gelo et al., 2008; Tillman et al., 2011).

Method

I designed the research study using the quantitative method. A researcher using the quantitative approach to the study of the stated phenomenon identifies relationships between numerical variables (Tillman et al., 2011). Benefits and costs measured in monetary units form the basis for CBA and CEA analysis (Levin & McEwan, 2002). Moreover, an evaluation of student outcomes measured CBA based on financial differences in median wage with differing levels of education (Oreopoulos & Petronijevic, 2013). Data from institutional financial records could form the basis for CBA analysis of financial outcomes (Chenhall et al., 2013).

Regulators evaluated college effectiveness using CEA analysis with a numerical representation of the initiative's value added (Cousins et al., 2014). CEA's ranking of alternative policy choices using monetized costs per fixed unit of benefits require numerical measurements (Levin & McEwan, 2002). On the other hand, the use of CEA rankings ease some of the complications required in CBA's quantification of outcomes (Grubb & Allen, 2011). Therefore, the ability to rank alternative outcomes based on numerical representations of costs with a fixed benefit supports decision-makers choice among mutually exclusive policy options (Rice, 2002).

The focus on conducting CBA and CEA related to the community college's financial outcomes required the analysis of numerical data. The use of CBA and CEA analysis required understanding the relationship between voluntary completion of NSAR and a student's decision to return to the CCC the following year. The regression equation documented the relationship between NSAR completion and retention.

The use of the institution's database and the NCES database provided natural settings for data collection that mitigated some of what Aguinis and Edwards (2014) described as external validity issues introduced by the researcher's presence in the data collection process. Vroom (1984) recommended the use of the quantitative research method in documenting the relationships between valence, instrumentality, and expectancy in reaching efficient decisions. Research conducted using the quantitative method is often generalizable across groups (Tillman et al., 2011). The objective nature of the study's research question regarding the relationship of student demographics, voluntary completion of NSAR, academic outcomes, and retention on the community college's financial results using ratio and categorical scaled data required a quantitative analytical method.

Alternatively, a qualitative approach to evaluating the strategic significance of implementing NSAR on the college's financial results might provide insights for decision-makers. Researchers using the qualitative method identify themes related to the stated phenomenon using a data set often gathered through an unstructured interview process (Gelo et al., 2008). The thematic nature of the qualitative approach supported the identification of new associations related to human perceptions (Mayoh & Onwuegbuzie, 2015). Researchers using the qualitative method focus on informant's lived experiences (Venkatesh et al., 2013). Errors or misidentification of qualitative themes might result from the researcher's influence on participant behavior by using a nonnaturalistic data collection tool or insufficient categorization and reflection on the qualitative data (Gelo et al., 2008). Documenting the saturation of the data using a sufficiently large sample set challenged qualitative researcher's conclusions regarding the data's depth (O'Reilly & Parker, 2013). The choice of the quantitative design focused the research on the numerical measurement of the changes in the institution's financial results and the relationships between the predictor and criterion variables.

Research Design

Investigating the relationship between student demographic factors, NSAR completion, academic outcomes, and retention used a correlational design. The analysis of the CBA and CEA required an understanding of the relationship between NSAR, a strategic initiative, and retention. Students in the NCES FT-FT 2011–2013 cohorts chose to complete or not complete NSAR before the beginning of this study. By using a correlational design, researchers explore causation by exclusion because causation does not exist without a correlational relationship (Charlwood et al., 2014). The absence of a correlation indicates that causation does not exist (Charlwood et al., 2014). By using a correlational design, researchers simultaneously analyze many variables using statistical techniques (Vroom, 1984). Statistical analysis of relationships provides researchers with an opportunity to gather data, perform analysis, and determine the statistical significance of hypothesized relationships (Tillman et al., 2011). Using a correlational design permits the examination of the relationship between the student attribute variables of NSAR completion, number of credits earned, GPA, and the dependent variable of retention while controlling for enrollment year, age, race or ethnicity, gender, socioeconomic group, and academic readiness without managing an experiment involving human participants.

Alternatively, an experimental design presents researchers with an ethical dilemma in defining the population or making assignment to the treatment and nontreatment groups if there is a potential for disparate impact (Wiles et al., 2012). Social science researchers avoided the use of interventions involving fixed attributes

(Charlwood et al., 2014). Ethical issues associated with the experimental design included research projects where student participants earned course credit as a reward (Leentjens & Levenson, 2013). In conclusion, a correlational design supported the analysis of the relationship between attributes without the ethical issues associated with experimental designs or the need to manipulate a fixed attribute.

Population and Sampling

The data set for the study included the CCC's institutional data for the fall 2011, fall 2012, and fall 2013 NCES FT-FT cohorts containing an average of 853 students each year. For each population member, the depersonalized data included student demographics, academic outcome, and retention information. The student demographic predictor variables included enrollment year, age, race or ethnicity, gender, socioeconomic group, and academic readiness. Academic outcome variables consisted of the number of credits earned and GPA for the student's first academic year. Based on the regulatory requirement to maintain a complete data set, few data points should be have missing information. The annual cohorts populations of 835, 849, and 874 exceeds the commonly accepted minimum regression size of 50 plus 20 times the number of independent variables ($50 + 9 * 20 = 230$). The statistical analysis using hierarchical logistic regression used the archival, population data provided by the institution. The availability of the archival, secondary data for the population from the CCC eliminated the need for sampling.

Researchers investigating questions surrounding student retention at colleges often use secondary data sets with information accumulated for reporting to NCES. Some researchers modeled the enrollment demand function using NCES information retrieved through the IPEDS data system (Hillman & Orians, 2013). A study of enrollment and financial need retrieved a data set from the IPEDS data center (Zhang et al., 2013). Other researchers conducted research using a data set from archival information used by the institution for reporting to NCES (Cook, 2014). Researchers analyzing enrollment trends often use archival population information developed by the institution for reporting to NCES or retrieve data sets from NCES through the IPEDS data access point.

Ethical Research

The reliance on archival, secondary data eliminated interactions between participants and me, and removed the need for informed consent, withdrawal protocols, or incentives. The data did not include any student identifiers, eliminating the necessity of implementing participant privacy protection policies. The disclosure, file security, and material destruction protocols complied with Institutional Research Board procedures at Walden University and the CCC. Appendices B, and C include documentation of the introduction of researcher, request for information, along with documentation security, storage, and destruction information. The Institutional Review Board-Walden University (IRB-W) assigned the approval number of 05-22-15-0388735 and the Institutional Review Board-the Connecticut community college (IRB-C) assigned the approval number of 5-13-15 for this study. The digital records on a password protected personal network and the bound notebook documenting oral communications are in a secure, locked box will be destroyed after 5-years in accordance with IRB-C and IRB-W standards to protect the rights of participants. Pseudonyms safeguard the anonymity of the Connecticut community college and information sources. CCC replaced the college's name. Pseudonyms identify personal communication sources within the CCC and the CSCU system.

Instrumentation

Quality research processes require attention to the methods used in gathering the data for analysis. The instruments or tools of data collection along with the methods of organization and analysis provide insights into the accuracy of any researcher's outcomes. Control over the collection and analysis process improves the reliability and validity of the study.

There were no new informal or formal surveys, no direct or participatory observation, no interviews, no focus groups, and no expert opinion used for data collection in the study. Instead, the study used archival data provided by the CCC. The collection procedure involved obtaining NCES cohort data for the fall 2011, 2012, and 2013 FT-FT cohorts from the CCC's Department of Institutional Research. Federal law requires that HEIs with federal contracts annually submit student demographic and organizational financial information (Clotfelter et al., 2013). Researchers who used existing federal databases improved the reliability of their work because of the accuracy of the database (E. W. Carter et al., 2013). The use of a natural, in the course of business, data collection process results in enhanced external validity in quantitative studies (Aguinis & Edwards, 2014). In the archival, secondary data set, the datum items did not identify individual students and included student demographic factors, academic outcomes, and retention information.

Social science researchers often use NCES reports and other archival data sets in their analysis. A quantitative review of student outcomes across California public community colleges used NCES data supplemented with data from internal institutional records (Bahr, 2012). Researchers frequently used NCES and IPEDS student outcome metrics as proxies for institutional quality (Bahr, 2013). An estimated demand curve for community college enrollment relied on NCES data in the linear regression model (Hillman & Orians, 2013). Many researchers based their quantitative data analysis on NCES sourced information (Bahr, 2013). The analysis of student graduation rates used logistic regression analysis (Kolenovic et al., 2013).

The predictor variables of student demographics and NSAR completion are categorical. The enrollment year used a scale of 1 (2011 cohort), 2 (2012 cohort), and 3 (2013 cohort). Following the CCC's record keeping, the age scale used 0 (24 years and under) and 1 (over 24 years). The race or ethnicity scale had 0 (Black or African American), 1 (Hispanic), 2 (White), and 3 (other). The gender category used 0 (male) and 1 (female). The student's socioeconomic group matched their financial aid status with 0 (received financial aid) and 1 (did not receive financial aid). A student's academic readiness indicated the student's placement in at least one developmental level course with 0 (placed in a developmental course) and 1 (did not place in a developmental course). The categories for NSAR completion used 0 (did not complete NSAR) and 1 (completed NSAR). The variable scales align with the reporting scales for NCES data submission.

The student's academic outcome variables had ratio values. The requested values for number of credits earned during the first academic year would be an integer between 0 and a reasonable expectation of a maximum value less than 45. The student's earned first semester GPA at the CCC after their first academic year was a rational number between 0.0 and 4.0 inclusive.

The criterion variable of retention was dichotomous with 0 (did not re-enroll at the CCC in the second fall semester) and 1 (enrolled at the CCC in the second fall semester). Appendix A includes a description of the variables. In accordance with the requirements of the Walden Institutional Research Board (IRB-W) and to protect the privacy of the information, the data set was password protected and will be permanently deleted after 5-years.

Additional information on the background and operation of the NSAR program included internal documents, and personal communication obtained with permission of the CCC in compliance with IRB-C and IRB-W protocols. The determination of changes in the organization's financial outcomes requires an analysis of the institution's costs for the NSAR program and the associated change in revenues resulting in a net financial gain or loss. The planned calculation of the financial results would use allocated resource costs and revenue stream information obtained from the CCC's financial statements, the institution's Finance Director, and knowledgeable others. The raw, depersonalized data will be available by request. Digital copies of documents are password protected, securely backed-up, and will be permanently deleted after 5-years. A hardbound research log contains the study information with documentation of my research activity. The log will be kept in a locked box in my home office for 5-years before destruction. When permitted, after scanning, paper documents, containing privileged information was shredded and disposed of properly. Paper documents, which cannot be digitized, are stored in the locked box with the research journal. All raw data will be destroyed after 5-years in accordance with IRB-C and IRB-W requirements.

Data Collection Technique

Archival, institutional information on student attributes and the institution's financial records were used to answer the primary research question regarding what information do administrators need about the relationship between demographic factors, NSAR completion, academic outcomes, and retention on financial sustainability. Collection of data for this study did not include any additional contact with any members of the fall 2011, 2012, or 2013 NCES FT-FT student cohorts. The college's data collection process is required to comply with the Higher Education Act of 1965 as amended (NCES, 2014b) and The Student Right to Know Act of 1990. The Site Agreement (Appendix B) and Data Use Agreement (Appendix C) document the research authorization process and conditions. Written information requests to the CCC's Institutional Research Department occurred after receipt of approval from the IRB-C and IRB-W. Full disclosure of the research project, the researcher's role, and receipt of written authorization to use disclosed data complied with IRB-C and IRB-W protocols before the collection of secondary data or requests for clarification or additional information.

The use of historical, archival data sources is common in quantitative research. Archival data is information collected by someone other than the researcher for a purpose not associated with a specific research project (Gelo et al., 2008). The use of archival data eliminates the possibility of reactivity or influence by the researcher on the data collection process (Gelo et al., 2009). Problems with data analysis associated with the choice of variables and their measurement scales might occur when the researcher does not control the measurement and definition of the variables (Greenhoot & Dowsett, 2012). Using archival data liberated the researcher from the financial and time constraints associated with the data collection process potentially resulting in increased attention to quality in the analysis phase of research (Alvarez et al., 2012). Large, national databases often use high–quality processes and have response rates greater than those reported in primary research (Alvarez et al., 2012).

Microsoft Office, Apple Preview, and IBM SPSS Statistics supported organizing and analyzing the collected data. The CCC used an Excel spreadsheet in reporting statistics such as matriculation year, age, race or ethnicity, gender, financial need, developmental course registration, NSAR completion, GPA, and retention data. The calculations of the significance of the relationship between the predictor and criterion variables used SPSS computations of the hierarchical logistic regression values. The Excel spreadsheet containing the source data set became the SPSS data file.

IRB-C and IRB-W compliant procedures guided all requests for data clarification or other personal communication information sources. The recording of all data collection activities used a bound notebook. The notebook, when not in use, is kept in a locked container in my home office and will be shredded after 5-years. The secure, locked container will store all authorizations for use of disclosed data. The digital files notes of all oral communications are on a password protected private computer network. After 5-years, all documents will be properly destroyed in accordance with IRB-C and IRB-W requirements.

Data Analysis

I used statistical and financial analytical techniques in developing an understanding of the relationship between a community college's implemented strategic initiative, retention, and financial sustainability. The primary research question was: What is the relationship between the independent variables of student demographic factors, completion of NSAR, GPA, and dependent variable of retention, and the affect on institutional financial sustainability? Hypothesis testing determined if a statistical relationship existed between the student attribute variables and retention outcomes using hierarchical binary logistic regression. Computing the financial sustainability impact of the relationship between NSAR and student retention required a documented change in the correlation for NSAR and not-NSAR students. The analysis of the regression results determined if CBA and CEA values could be computed for the implemented strategic initiative.

Statistical Analysis

Binary logistic regression provides a platform for the analysis of relationships between predictor variables of various scales and a dichotomous, categorical criterion variable (Genest et al., 2013). Researchers using binary logistic regression measure the statistical significance of the odds that changes in a predictor variable relate to changes in a criterion variable (Lamb & Annetta, 2013). The relative size of the computed regression weights, known as beta coefficients, provide researchers with an indication of the relative importance of each variable as a predictor of the relationship between the independent and dependent variables (Nimon & Oswald, 2013). Investigating the relative importance of the predictor variables provides additional depth to the regression analysis (Tonidandel & LeBreton, 2013). The predictor variables are assumed to have nonlinear relationships with each other so that two predictor variables do not measure the same construct (Tonidandel & LeBreton, 2010). Nonparametric analysis provides a framework for the statistical analysis of relationships when the variables violate the assumptions for parametric models (Derrac et al., 2011).

Hierarchical logistic regression methodology uses blocks of variables in determining the relationships between multiple independent variables and the dependent variable (French et al., 2013). Measuring the relationship of a set of control, independent variables, and the focus independent variables permits the multivariate regression analysis to highlight the key variable's relationship with the dependent variable (French et al., 2013). Education researchers often use hierarchical logistic regression in analyzing student retention decisions (French et al., 2003). Additionally, researchers often establish the hierarchical order of variables based on the longitudinal pattern of variable acquisition with student demographic variables entered before academic outcome variables (French et al., 2003). Therefore, the order of entry for the independent variables was the control variables of enrollment year, age, race or ethnicity, gender, socioeconomic group, academic readiness, followed by NSAR completion, credits earned, and GPA.

The hypothesis testing for the relationship between student demographic factors, NSAR completion, academic success, and retention used hierarchical logistic regression. The variables for the study, described in Appendix A, included cognitive and noncognitive variables that documented student attributes. The control, student demographic, predictor variables were categorical and included depersonalized student data on enrollment year, age, race or ethnicity, gender, socioeconomic group, and academic readiness. NSAR completion was a dichotomous predictor variable. The planned two ratio predictor variables would measure academic success in the first academic semester with credits earned and GPA. Retention, the dichotomous criterion variable recorded the student's decision to remain enrolled for the next academic year at the CCC. In the regression model, the equation modeled the preferred outcome for the criterion variable of a student returning to the college for their second academic year.

ANOVA, MANOVA, multiple linear regression, and other parametric models required compliance with several assumptions that the study's data set did not meet. Common parametric assumptions included linearity of the relationship, error independence, normal distributions, and equal variance (Berenson, 2013). Many regression algorithms require noncategorical predictor variables.

The analysis used retention as the output variable on a dichotomous scale. The assumptions for binary logistic regression include assuming independence of the predictor variables and a logistic linear relationship between the predictor variables and the criterion variable (Tonidandel & LeBreton, 2010). Regression analysis does not document causal relationships between variables (Clotfelter et al., 2013). The use of a dichotomous criterion or dependent variable violates the requirements for using multiple linear regression modeling. The use of hierarchical regression focused the research on predictor variables that were the most predictive of the relationship between predictor and criterion variables (Bien & Tibshirani, 2013).

Initial evaluation of the regression calculations compared the Hosmer and Lemeshow goodness-of-fit test, Cox and Snell R^2 and Nagelkerke R^2 at the probability of a Type I error (α) rate of 0.05 level of significance. R^2 values measured effect size (Hidalgo, Gómez-Benito, & Zumbo, 2014). Observing the regression model's beta coefficients identified each predictor variables' standardized contribution to the equation (Ray-Mukherjee et al., 2014). It is important for researchers to document the relative importance of predictor variables in regression models beyond the calculated regression coefficients (Braun & Oswald, 2011).

Using a multiple lens approach enhanced the researchers ability to identify shared variance between predictor variables with standardized beta weights, and structured coefficients in measuring the portion of total variance assigned to each predictor variable (Nathans, Nimon, & Walker, 2013). Nonfocal variables might suppress the influence of the primary variable in regression analysis (O'Neill, McLarnon, Schneider, & Gardner, 2013). Post-hoc procedures such as partitioning predictor variables individually and in sets aided in the decision process for including or removing predictor variables and determining the key, known, independent variables to a relationship (Ray-Mukherjee et al., 2014; Tonidandel & LeBreton, 2011). Investigating the multicollinearity of the predictor variables evaluated the correlations between predictor variables (Braun & Oswald, 2011; Genest et al., 2013). Through an analysis of the -2-Log-Likelihood, Chi-Squared (χ^2), and Wald output the significance of each predictor variable in the regression equation was determined.

Several assumptions apply to using hierarchical logistic regression statistical modeling. As with any model, the assumptions included a properly defined model with accurately measured variables. Appropriately defining parameters with efficient measurements leading to the development of unbiased estimators of the criterion variable is an important component of research design (Williams, 2012). The institution's maintenance of their database of student self-reported attributes and institutional data in compliance with federal NCES reporting standards minimized the possibility of a recording error in a variable. The chosen independent variables and their scales aligned with variables regularly considered in evaluating student retention decisions.

One assumption for the regression analysis was that the predictor variables had nonlinear relationships with each other (Tonidandel & LeBreton, 2010). Hierarchical statistical analysis documented the appropriate variables for inclusion in the final analysis using available student demographic attributes, NSAR participation, academic success factors, and each student's retention decision. Only one variable that measured the same construct was included in the final regression formula to control for the collinearity assumption between independent variables. In using hierarchical logistic regression statistical analysis, researchers assume that the existence of a linear logistic relationship between the independent predictor variables and the dichotomous criterion variable (Tonidandel & LeBreton, 2010). A scatter plot of the regression residuals along with a comparison of the absolute values of the residuals to the absolute value of the critical value documented the extent of the variance between the model's predictions and the data set values.

I used statistical analysis software including Microsoft Excel and SPSS software in computing the output to test the hypothesis. I asked the CCC for depersonalized student information on student enrollment year, gender, race or ethnicity, age, financial need, academic readiness, NSAR completion, credits earned, GPA, and retention using an Excel spreadsheet. A self-designed Excel spreadsheet combined the information from the college's audited financial statements and internal reports.

U.S. colleges maintain student databases in compliance with the Higher Education Act of 1965 as amended (NCES, 2014b) and The Student Right to Know Act of 1990. Archival data collected in the course of business and compliance with federal data reporting standards is expected to have few if any missing data cells. Empty or blank data sets were evaluated on a case-by-case basis.

Financial Analysis

Understanding the efficiency of resource allocation decisions requires consideration of difficult to quantify outcomes (Duncombe & Yinger, 2011). Evaluators using values engaged evaluation (VEE) analysis measure program outcomes (Luskin & Ho, 2013). Several analysts recommended employing a value-added approach in measuring the financial impact of change processes (Duncombe & Yinger, 2011;

Gronberg et al., 2011). The analysis of the financial implications of the NSAR initiative compared NSAR expenses and the predicted change in revenue associated with changes in retention based on the relationship developed in the regression. CBA and CEA determined the present value of the college's labor and capital resources allocated to NSAR, resources allocated to student recruitment, and student advising programs. Additional cost factors included opportunity costs for the college resources and the student's alternative use of their time, and student direct costs for attending NSAR.

In CBA, the present value of stakeholder benefits include the revenue sources of public funding, tuition, fees, bookstore, cafeteria, and other revenue streams. The CBA process resulted in a dollar net gain or loss equal to the net present value difference between total benefits and total cost (Clune, 2002; Levin & McEwan, 2002). Employing a CBA analytical approach provides decision-makers with dollar comparison of processes with different combinations of goals and costs (Levin & McEwan, 2002). The CBA computation determines the difference between the change in revenues in the next year related to changes in retention and the allocated expenses for operating NSAR (CBA_n = Change in $revenues_{n+1}$ – allocated NSAR $expenses_n$) in the prior year, yielding the net gain (loss) associated with the program.

Researchers using CBA analysis effectively document wage differentials associated with completion of higher education credits (Oreopoulos & Petronijevic, 2013). The inability of an analyst in calculating the present value of future wage differentials impeded the accuracy of the CBA approach's measurement of stakeholder benefits (Hillman & Orians, 2013). The CBA process proved useful in measuring the relationship between nonretention of students and the institution's financial outcomes (Schuh & Gansemer-Topf, 2012).

CEA also considered benefits to other stakeholders such as the difficult to quantify outcomes of improved social and economic results for the student, the student's family, businesses, the local community, and the public (Levin & McEwan, 2002). The CEA process identifies the ratio of the change in outcomes to the dollar cost for each basis-point change in the retention rate. By including CEA analysis of educational outcomes, researchers broadened the understanding of the effectiveness of institutional decision-making (Rice, 2002). The use of CEA computations eliminated the need to place a monetary value on difficult to quantify, intangible outcomes (Grubb & Allen, 2011). The calculation of the CEA ratio of the cost to increase the retention rate by one basis point compares the NSAR expenses and the change in retention rate for the same year (CEA_n = allocated NSAR $expenses_n$ /change in retention $rate_n$).

Decision-maker's goals might conflict with stakeholder goals requiring information for decision-makers from multiple perspectives (Reynolds, 2014). The inclusion of quantified results from past programs aimed at improving RG rates in the decision-making process has improved future decision-making (Tinto, 2012). The president of the CCC received a copy of the study and an executive summary with the statistical analysis of the relationship between NSAR and retention, and indication of gaps in knowledge, and recommendations for further action.

Study Validity

The goal of management researchers is the development of knowledge with an understanding of how practitioners might use the information (Aguinis & Edwards, 2014). The quality of the conclusions drawn from the results of the correlational study of the information needs of decision-makers depends on the validity of the data collection, statistical computations, financial analysis, and interpretation of the computations. Validity indicates if the measurement measures the intended construct (Rice, 2013).

Internal and external validity considers the accuracy of the collected data, any bias introduced by the data collection process, and the implications of any missing data. Internal validity addresses the accuracy of computed relationships between the independent and dependent variables (Beal & Pascarella, 1982). The internal validity of research reflects the confidence of the researcher in their causal conclusions (Aguinis & Edwards, 2014). The use of a correlational design focused on relationships in place of causation and eliminated validity concerns regarding causal ties between independent and dependent variables (Nimon & Oswald, 2013).

Measurement validity considers the precautions taken in collecting and interpreting the data set (Rice, 2013). Data integrity issues might result from either intentional or inadvertent response errors resulting in reduced reliability for student self-reported datum (Kahu, 2013). The student records providing documentation by student of enrollment year, age, race or ethnicity, gender, financial aid awards, enrollment in developmental courses, NSAR completion, credits earned, GPA, and continued enrollment are protected by BOR data security processes that control the entry, retrieval, and editing of student records (R. Boune, personal communication, January 28, 2014).

The use of the secondary data set maintained by the CCC for reporting to the federal government through NCES reporting standards removed any possible data collection error by the researcher. The CCC's compliance with federal standards for data collection and reporting reduced the likelihood of errors in datum points. Improved validity of archival data sets results from the national collection processes with high response rates (Alvarez et al., 2012). In an effort to verify the accuracy of the data set, I visually checked the data set provided by the CCC's Department of Institutional Research for values that appear as outliers and any missing datum points.

The college's application process requires student self-reporting of their gender and ethnicity information. Between 2011 and 2013, the CCC converted the application process from a predominantly manual process to a predominantly online application resulting in the increased use of online enrollment forms (R. Boune, January 28, 2014). Data entry errors in converting the paper application information to the student's digital record might cause a decrease in internal validity. BOR and CCC procedures for employee selection, training, supervision, and evaluation minimized the frequency of data entry errors.

Student demographic information included student self-reporting of their gender and ethnicity. Not all students chose to identify their ethnicity (T. Vice, personal communication, June 13, 2014). Inaccuracies in student self-reported information might result from misunderstanding the question, data form completion errors, or from bias

(Kahu, 2013). The use of the population data in the analysis limited the influence of any one self-reporting error.

The conversion of the institution's allocated resource costs and revenue stream information might introduce data entry errors. The spreadsheet values were double checked to identify any data entry errors or missing datum values. The use of the CCC's audited financial records minimized possible errors in the values.

The external validity of the research process refers to the generalizability of the conclusions across different contexts and populations (Beal & Pascarella, 1982). The external validity of management research would improve with the standardization of measurement tools and constructs (Aguinis & Edwards, 2014). Additionally, research designs that use experimental or quasi-experimental designs introduce external validity issues based on the selection of the treatment and nontreatment groups (Aguinis & Edwards, 2014). Using data collected in the course of business operations, a natural setting, reduced the external validity threats (Aguinis & Edwards, 2014).

The collection and analytical processes for determining the retention rates, cost-effectiveness outcomes, and cost-benefit analysis are generalizable across research questions, and are tools for determining the influence of a strategic initiative on a college's financial sustainability. Changing student demographics, economic conditions, or regulatory processes might alter the effectiveness of NSAR and the cost-benefit computations without altering the effectiveness of the model for evaluating a strategic initiative.

Threats to the validity of the statistical conclusions will develop from the limitations associated with the use of hierarchical logistic regression analysis and hypothesis testing. Type I error, a false positive, refers to conclusions indicating that the null hypothesis is false when it is true (Hidalgo et al., 2014). Acceptance of the null hypothesis when it is false is a false negative or Type II error. Large sample sizes might result in an increase in Type I errors and larger power resulting in less reliable regression outputs (Hidalgo et al., 2014). Evaluation of significance was at the 0.05 level for the Wald test factor and sought large p values for Cox and Snell R^2 and Nagelkerke R^2, Hosmer and Lemeshow goodness-of-fit test.

The use of an appropriately large number of data points enhances the validity of a quantitative study. The probability of obtaining a representative sample improved with the use of a qualified sampling technique and a sufficiently large sample. Too small a sample presents the possible violation of that the law of large numbers, and the chosen sample is not representative of the population leading to a conclusion supported by the sample and not by the population. This study's use of the population data set, minus an anticipated small number of students with missing datum, eliminates the validity issues associated with sampling strategies and small sample sizes. Moreover, the use of statistical tests for evaluating the assumptions and the population mitigated threats to the statistical validity of the conclusions.

Transition and Summary

Section 2 of the study provided a detailed explanation of the planned research method, data analysis, and indicators of quality concerning the information needs of decision-makers regarding the financial results of implemented strategies. The analysis plan for evaluating the financial impact of the NSAR program at the CCC permits the documentation of the relationship between one implemented strategic initiative and a community college's financial sustainability. The role of the researcher identified the possible impact on retention outcomes associated with my faculty position and limited participation as a faculty NSAR advisor for business majors in 2011. The use of an anonymous, archival data set provided by the CCC simplified the data collection and storage requirements. The descriptions of the IRB-C and IRB-W procedures documented compliance with the Belmont report and both institutions' research board requirements. The next section, Section 3 describes the statistical analysis of the data set, identifies and evaluated the costs and benefits associated with changes in retention related to NSAR completion, quantify the financial impact of the initiative, and enumerate suggestions for business practice and further research.

Section 3: Application to Professional Practice and Implications for Change

Introduction

The purpose of this quantitative, correlational study was to inform college administrators about the relationship between the independent variables of student demographic factors, completion of NSAR, GPA, and the dependent variable of retention, and the effect on institutional financial sustainability. The Connecticut community college (CCC) designed and implemented NSAR to improve student retention, progression, and graduation rates. The examination of the change in retention correlating with NSAR completion used hierarchical, binary linear regression. The analysis did not support the calculation of NSAR's cost-benefit and cost-effectiveness or improvements in the CCC's financial sustainability associated with offering NSAR. The findings from this study might improve resource allocation decision-making supporting gains in student educational outcomes leading to increases in society's labor productivity, income growth, and improved quality of life.

Using SPSS version 21, the analysis of the regression output showed that a correlation existed between students completing NSAR and students returning to the CCC for the following fall semester. A comparison of the probability of retention for NSAR and not-NSAR students showed that the 95% confidence intervals overlapped. Consequently, the probability of retention for NSAR and not-NSAR students might be the same. Therefore, there was no documented improvement in retention indicating that the costs of operating NSAR were not justified based on improvements in retention rates. Overall, the decision to offer NSAR to matriculating NCES fall cohort students was not supported by the analysis and the analysis could not show gains in the CCC's financial results. Other factors might justify the allocation of resources for NSAR.

Presentation of the Findings

The use of hierarchical, binary linear regression permitted the examination of the possible correlation between student attributes and retention following the implementation of a strategic initiative. Binary linear regression allowed the analysis of categorical predictor variables with a dichotomous, categorical criterion variable (Genest et al., 2013). The outcome of the regression indicated the odds likelihood that changes in one or more of the predictor variables correlated with changes in the criterion variable (Lamb & Annetta, 2013). The introduction of the student demographic variables of enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness as control variables isolated preexisting student attributes from the influence of NSAR. The use of the hierarchical regression methodology focused the analysis on the covariance assigned to attributes measured after the student decided to enroll as a member of a fall FT-FT student cohort at the CCC. Administrators' implementation of strategic decisions might influence student retention decisions.

Data Set Description

Archival data collected by the CCC in compliance with NCES reporting standards included student demographic, academic, retention, and NSAR status for the Fall 2011, 2012, and 2013 cohorts of FT-FT students formed the data set for the statistical analysis. All student personal identifiable information was removed, and the CCC assigned each student record a random number before releasing the data set. The control variables included the student demographic factors of enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness. The proposed variable indicating the number of credits earned in the first semester was removed from the study because the CCC did not provide the data points.

The initial review of the data set determined that 64 students had no earned GPA for their first academic semester. Students without an earned GPA included students who (a) withdrew from all their courses, (b) successfully or unsuccessfully completed developmental courses, (c) arranged for incomplete grades, (d) earned N grades by completing no course work, or (e) any combination of the above. Earned GPAs ranged from 0 to 4.0 indicating completion of college-level academic work. The identification of a meaningful, nonnumeric GPA value required the recoding of GPA from the planned continuous ratio variable to a polytomous, categorical variable. The data set included no missing or blank data points after recoding the GPA variable. The reporting of the descriptive statistics for GPA used the earned GPA value and excluded the 64 students without GPAs.

The recoded data set included eight predictor variables and one criterion variable. The enrollment year used a scale of 1 (2011 cohort), 2 (2012 cohort), and 3 (2013 cohort). The age scale used 0 (24 years and under) and 1 (over 24 years). The ethnicity scale had 0 (other), 1 (Caucasian), 2 (African-American), 3 (Hispanic), and 4 (Multiple Races). The gender category used 0 (male) and 1 (female). The student's socioeconomic group coded their financial aid status with 0 (received financial aid) and 1 (did not receive financial aid). A student's academic readiness indicated the student's enrollment in at least one developmental level course during their first semester with 0 (enrolled in at least one developmental education course) and 1 (did not enroll in a developmental education course).

The predictor variables entered after the control variables included NSAR completion and first semester GPA at the CCC. The categories for NSAR completion were 0 (did not complete NSAR) and 1 (completed NSAR). The student's academic outcome variable was coded using the student's GPA after their first academic semester. The GPA coding was 0 (blank GPA), 1 (GPA < 0.5), 2 ($0.5 \leq$ GPA < 1.50), 3 ($1.50 \leq$ GPA < 2.5), 4 ($2.5 \leq$ GPA < 3.5), and 5 ($3.5 \leq$ GPA).

The criterion variable of retention indicated if the student reenrolled at the CCC during the following fall semester. Retention was dichotomous with 0 (did not reenroll at the CCC in the second fall semester) and 1 (enrolled at the CCC in the second fall semester). Appendix A provides a description of the variables.

Descriptive Statistics

The analysis of the summary statistics for the data set, shown in Table 1, indicated consistency of student demographic attributes across the 2,558 students in the 2011, 2012, and 2013 fall FT-FT cohorts. The student cohort years contained almost identical percentages of students with 33% in 2011, 34% in 2012, and 33% in 2013. Ninety-one percent of the students were under 25 years of age. The mix of student ethnicities was similar across the three cohort groups with an average of 41% Caucasian, 26% African-American, 24% Hispanic, 3% Multiple Races, and 6% other. Female students were 49.5% of the total data set. Seventy-seven percent of the students received financial aid.

The students were underprepared for college level studies with 77% enrolling in at least one developmental education course in their first semester. The percentage of students completing NSAR demonstrated by registering online grew annually from 67% in 2011 to 84% in 2013 with an average completion rate of 73%. Cohort students began as full-time students enrolled in a minimum of 12 credits during their first semester and on average earned a first semester GPA of 2.20 with a standard deviation of 1.36. Students returned to the CCC the following fall semester at an average rate of 58.7%. On average, 60.6% of NSAR completers and 53.4% of students who did not complete the NSAR returned to the CCC for the following fall semester. The retention pattern showed an annual increase in the retention of 3.3% from 2011 to 2012 and 2.0% from 2012 to 2013.

Table 1

Descriptive Statistics

Attribute	Fall 2011	Fall 2012	Fall 2013	3-Year (count)
Percentage under 25	90.8%	89.6%	91.4%	90.6% (2317)
Ethnicity				
Caucasian	40.5%	40.3%	41.8%	40.9% (1045)
African-American	28.6%	24.7%	23.4%	25.6% (654)
Hispanic	21.2%	25.6%	24.8%	23.9% (611)
Multiple Races	3.5%	3.5%	3.2%	3.4% (88)
Other	6.1%	5.8%	6.8%	6.3% (160)
Percentage female	47.7%	49.9%	51%	49.5% (1267)
Received financial aid	78.1%	76.9%	74.9%	76.6% (1960)
Enrolled in at least one developmental education course	80.3%	77.6%	73.7%	77.2% (1975)
Completed NSAR	67.4%	67.6%	84.1%	72.9% (1865)
Average earned GPA	2.07 *M* 1.36 *SD*	2.28 *M* 1.38 *SD*	2.26 *M* 1.33 *SD*	2.20 *M* 1.36 *SD*
Retention rate: Average	57%	58.9%	60.1%	58.7% (1501)
completed NSAR				60.6%
Did not complete				53.4%
Number of students	33% (849)	34% (874)	33% (835)	100% (2558)

Binary Logistic Regression Analysis

A binary logistic regression analysis was conducted to evaluate the research question of what the relationship was between NSAR completion, number of credits earned, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness. Binary logistic regression develops an equation documenting the correlation between predictor variables and a dichotomous criterion variable (Paul, Pennell, & Lemeshow, 2013). The hypotheses set stated the following:

Null Hypothesis (H_o): There was no relationship between NSAR completion, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness.

Alternative Hypothesis (H_a): There was a relationship between NSAR completion, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness.

The goodness-of-fit test for binary logistic regressions usually uses the Hosmer and Lemeshow test (χ^2_{HL}) with a χ^2 distribution because of the test's simplicity and its inclusion in most statistical software packages (Fagerland & Hosmer, 2013). Alternative measures of fit include Cox and Snell R^2 and Nagelkerke R^2. The three measures of fit $\chi^2_{HL,}$ $R^2_{\text{Cox \& Snell}}$, and $R^2_{\text{Nagelkerke}}$ indicate limited model fit at small significance levels. Larger significance levels indicate stronger model fitting. The Hjort-Hosmer test might be more accurate by increasing the power but it is harder to calculate and less frequently used with binary logistic regression (Quinn, Hosmer, & Blizzard, 2015).

The minimum requirements for reliable Hosmer and Lemeshow test statistics require splitting the data set into groups with a minimum of five items per group, with more than five total groups, and the study of nonsmall events (Paul et al., 2013). The test follows a χ^2 distribution with degrees of freedom two less than the number of groups (Paul et al., 2013). Successful use of the Hosmer and Lemeshow test requires studies with fewer than 25,000 items (Paul et al., 2013). The analysis of student retention developed 10 groups, and included the population of 2,588 students with an average retention rate of 58.7% meeting the requirements for using the Hosmer and Lemeshow test. The model developed a strong fit indicated by $\chi^2_{HL}(8, N = 2558) = 2.964$, $p = 0.937$. Thus, the null hypothesis is rejected, and there was a relationship between NSAR completion, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness.

The output of the hierarchical, binary regression reported the statistics for the model with only the blocked student attribute variables and after the entry of NSAR and GPA. Table 2 includes the summary statistics for the regression model. The blocked student attributes of enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness were control variables. The regression using the control variables, before NSAR and GPA, developed a -2LL = 3425.619, $R^2_{\text{Cox \& Snell}} = 0.017$, $R^2_{\text{Nagelkerke}} = 0.022$ with statistical significance at the 0.05 level of significance. The $\chi^2_{HL}(8, N = 2558) = 8.328$, $p = 0.402$ showed a relatively small significance. With only the control variables, the model correctly predicted 60.1% of the retention decisions.

The model developed statistically significant results with the inclusion of NSAR and GPA, and improved the prediction of retention outcomes to 70.8%. The model reduced unexplained variance by 13% with a -2LL = 2982.987. The model with NSAR and GPA ($\chi^2_{HL}(8, N = 2558)$, = 2.964, p = 0.937) more closely fit the data set and more fully explained the relationship with student retention. As shown in Table 2, the alternative measures of R^2, $R^2_{Cox\ \&\ Snell}$ = 0.173, $R^2_{Nagelkerke}$ = 0.233 indicate a level of model fit below 0.50. The findings from the regression indicated that a significant relationship existed between NSAR completion, GPA, and retention while controlling for enrollment year, age, ethnicity, gender, socioeconomic group, and academic readiness. The Hosmer and Lemeshow test supported the rejection of the null hypothesis. Moreover, the regression model documented that a relationship existed between the student attributes, NSAR, GPA, and retention.

Table 2

Model Significance Statistics

Variables	Predicted correctly	Hosmer & Lemeshow Test (χ^2_{HL})			Model summary		
		Chi-square	*df*	Sig.	-2 Log likelihood	Cox & Snell R^2	Nagelkerke R^2
Control	60.1%	8.328	8	.402*	3425.619	.017	.022
All	70.8%	2.964	8	.937*	2982.987	.173*	.233*
Outliers Removed	70.8%	3.236	8	.919*	2981.033	.173*	.233*

Note. *p > .05.

Significant variables. Further review of the output (see Table 3) indicated that age, NSAR, and GPA had statistically significant relationships with retention. The Wald test statistic is the square of the independent variable's coefficient divided by the its squared standard error indicating the statistical significance of the variable in the model and follows a chi-squared distribution (Dwek, McBain, Cleanthous, Shipley, & Newman, 2015). Based on the Wald statistic (1, $N = 2588$) = 4.322, $p = 0.038$, $\exp(\beta)_{\mathrm{Age}} = 1.381$, 95% CI [1.019, 1.872], age showed statistical significance indicating that the odds of returning to the CCC for students older than 24 was 38% greater than for younger students. The 95% confidence interval for the odds of returning was 1.019:1 to 1.872:1 indicated that odds of an older student (age = 1) returning were greater than for younger students (age = 0).

The student's first semester GPA developed Wald statistics between 6 and 366 with a statistical significance of 0.000 for all levels except 5. The Wald statistic for students with the highest GPAs had a significance level of 0.012. The 95% confidence intervals for each level developed a maximum value of 0.520:1 except GPA 5 with a confidence interval of 0.542:1 to 0.927:1. The $\exp(\beta)$ for each level of GPA were $\exp(\beta)_{\mathrm{GPA1}}(1, N = 2588) = 0.103$, $\exp(\beta)_{\mathrm{GPA2}}(1, N = 2588) = 0.074$, $\exp(\beta)_{\mathrm{GPA3}}(1, N = 2588) = 0.236$, $\exp(\beta)_{\mathrm{GPA4}}(1, N = 2588) = 0.390$, and $\exp(\beta)_{\mathrm{GPA5}}(1, N = 2588) = 0.709$. As a student's GPA increased, the odds of retention grew. Therefore, age, a control variable, and GPA developed statistically significant Beta coefficients indicating that age and GPA correlated with retention.

Understanding which variables did not develop significant regression coefficients aids in developing a deeper understanding of which student attributes correlate with retention. Table 3 summarized the statistical output for the full regression model with the blocked student demographic variables, NSAR, GPA, and retention. In the full model, enrollment year, ethnicity, gender, socioeconomic group, and academic readiness each developed Wald statistic significance of $0.140 < p < 0.974$, all greater than the required 5% level of significance. During the control step of the regression without NSAR and GPA, three student demographic attributes had significant correlations with retention. As shown in Table 4, ethnicity–other resulted in a Wald statistic $(4, N = 2558) = 14.542$, $p = 0.006$ indicating that ethnicity might correlate with retention and the categorized ethnicity values did not develop significant regression coefficients. Gender developed a Wald statistic $(1, N = 2558) = 11.330$, $p = 0.001$, $\exp(\beta)_{gender} = 0.760$, 95% CI [0.647, 892] illustrating the odds for a female student (gender = 1) returning were less than the odds for a male student (gender = 0) returning in the control step. Academic readiness was significant with a Wald statistic $(1, N = 2558) = 6.460$, $p = 0.011$, $\exp(\beta)_{academic\_readiness} = 0.774$, 95% CI [0.635, 0.943]. The odds of an academically prepared student (academic readiness = 1) were smaller than the odds of an academically underprepared student (academic readiness = 0) returning for the following fall semester. In conclusion, enrollment year, age, and socioeconomic group did not develop statistically significant beta coefficients in the control step of the regression; these student attributes did not correlate with retention.

The evaluation of multicollinearity used the standard error terms shown in Table 3. Each variable's computed standard error was less than 0.350. Any possible multicollinearity among the predictor variables was ignored because the standard errors were all less than 2.000.

Table 3

Model With All Variables

	ß	*SE*	Wald	*df*	Sig.	Exp(*ß*)
Enrollment year ‘11	–	–	.053	2	.974	–
Enrollment year ‘12	.005	.111	.002	1	.962	1.005
Enrollment year ‘13	-.018	.111	.028	1	.867	.982
Age(1)	.323	.155	4.322	1	.038*	1.381
Ethnicity	–	–	5.047	4	.282	–
Ethnicity(1)	.443	.300	2.177	1	.140	1.557
Ethnicity(2)	.010	.246	.002	1	.967	1.010
Ethnicity(3)	.016	.251	.004	1	.951	1.016
Ethnicity(4)	.073	.253	.082	1	.774	1.075
Gender(1)	-.106	.090	1.391	1	.238	.899
Socioeconomic group(1)	-.084	.111	.571	1	.450	.920
Academic readiness(1)	.042	.111	.147	1	.702	1.043
NSAR(1)	-.220	.102	4.664	1	.031*	.802
GPA	–	–	365.739	5	.000*	–
GPA(1)	-2.273	.300	57.379	1	.000*	.103
GPA(2)	-2.601	.160	262.753	1	.000*	.074
GPA(3)	-1.443	.166	75.089	1	.000*	.236
GPA(4)	-.942	.147	41.264	1	.000*	.390
GPA(5)	-.344	.137	6.326	1	.012*	.709
Constant	1.148	.320	12.859	1	.000*	3.153

Note. Exp(*ß*) = exponentiated Beta; NSAR = New Student Advising and Registration. *$p < .05$; – represents a blank cell.

Table 4

Model With Blocked Control Variables

	ß	*SE*	Wald	*df*	Sig.	Exp(*ß)*
Enrollment year ‘11	–	–	.694	2	.707	–
Enrollment year ‘12	-.081	.100	.657	1	.418	.922
Enrollment year ‘13	-.025	.100	.062	1	.803	.975
Age(1)	.112	.139	.647	1	.421	1.118
Ethnicity	–	–	14.542	4	.006*	–
Ethnicity(1)	.515	.275	3.517	1	.061	1.673
Ethnicity(2)	.255	.225	1.286	1	.257	1.291
Ethnicity(3)	-.063	.229	.074	1	.785	.939
Ethnicity(4)	.218	.231	.894	1	.344	1.244
Gender(1)	-.275	.082	11.330	1	.001*	.760
Socioeconomic group(1)	-.133	.101	1.717	1	.190	.876
Academic readiness(1)	-.257	.101	6.460	1	.011*	.774
Constant	.557	.285	3.834	1	.050*	1.746

Note. Exp(*ß)* = exponentiated Beta.
**p* < .05; – represents a blank cell.

Binary regression analysis by enrollment year. Conducting the binary logistic regression analysis with the data set separated by Fall enrollment cohorts resulted in different levels of model significance as shown in Table 5, and identified similar groups of significant variables reported in Table 6. In 2011, the results ($\chi^2_{HL\text{-}2011}(8, N = 874)$, = 2.964, $p = 0.607$, $R^2_{Cox\ \&\ Snell} = 0.150$ and $R^2_{Nagelkerke} = 0.202$) were statistically significant, showing a correlation between student attributes and retention. As shown in Table 6, the 2011 cohort demonstrated statistically significant correlations between GPA levels 0 to 4 and retention with $0.000 \le p \le 0.006$. The cohort’s NSAR Wald test (1, $N = 874$) = 6.356, $p = 0.334$ was not significant.

Table 5

Model Statistical Significance by Enrollment Year

Year	Predicted correctly	Hosmer & Lemeshow Test (χ^2_{HL})			Model summary		
		Chi-square	*df*	Sig.	-2 Log likelihood	Cox & Snell R^2	Nagelkerke R^2
2011	71.3%	6.356	8	.607*	1022.058	.150*	.202*
2012	70.2%	11.378	8	.181*	996.621	.193*	.260*
2013	68.8%	2.466	8	.963*	944.333	.193*	.261*

Note. $*p > .05$

Advancing to 2012, the second year that NSAR was offered, the results ($\chi^2_{HL\text{-}2012}(8, N = 849)$, = 11.378, $p = 0.181$, $R^2_{Cox\ \&\ Snell} = 0.193$ and $R^2_{Nagelkerke} = 0.260$) indicated that the regression was not statistically significant. The goodness-of-fit values indicated that the model explained about 20% of the variance. A significant relationship did not exist between the 2012 student's attributes and retention. No analysis of variable betas was conducted because the regression was not significant. The CCC relocated to a new combined campus for the start of the Fall 2012 semester. Accordingly, the lack of a statistically significant model during the transition period might be related to the stress and temporary disorganization associated with the move.

In the third year, the results ($\chi^2_{HL\text{-}2013}(8, N = 835)$, = 2.466, $p = 0.963$, $R^2_{Cox\ \&\ Snell} = 0.193$ and $R^2_{Nagelkerke} = 0.261$) showed statistical significance indicating that the 2013 student attributes were correlated with retention. GPA levels 0 to 4 were statistically significant with $p = 0.000$. In 2013, the constant term's Wald test $(1, N = 835) = 8.781$, $p = 0.003$ was statistically significant. Additionally, the results for NSAR's Wald test $(1, N = 835) = 6.041$, $p = 0.014$ were statistically significant with Exp(β) = 0.589. The probability of returning for NSAR completers in 2013 was 0.371. The improvement in NSAR's significance might reflect enhancements made to NSAR programming introduced for the 2013 cohort.

Table 6

2011 and 2013 Year Variables With Significant Wald Test Results

	ß	*SE*	Wald	*df*	Sig.	Exp(*ß)*
			Enrollment 2011			
GPA	–	–	107.687	5	.000*	–
GPA(1)	-2.467	.608	16.465	1	.000*	.085
GPA(2)	-2.390	.277	74.627	1	.000*	.092
GPA(3)	-1.147	.294	15.253	1	.000*	.318
GPA(4)	-.730	.266	7.532	1	.006*	.482
			Enrollment 2013			
NSAR(1)	-.529	.215	6.041	1	.014*	.589
GPA	–	–	134.921	5	.000*	–
GPA(1)	-2.121	.462	21.083	1	.000*	.120
GPA(2)	-2.745	.291	89.231	1	.000*	.064
GPA(3)	-1.965	.292	45.297	1	.000*	.140
GPA(4)	-1.153	.257	20.069	1	.000*	.316
Constant	1.765	.596	8.781	1	.003*	5.842

Note. Exp(*ß)* = exponentiated Beta; NSAR = New Student Advising and Registration.
**p* < .05; – represents a blank cell.

Receiver operating characteristics. Reviewing the Receiver Operating Characteristics (ROC) graph provided an alternative approach for documenting the significance of age, NSAR, and GPA. Determining the explained area under the curve (AUC) associated with each significant variable in the regression documented the strength of the correlation between the predictor and criterion variables. In Figure 1, the graph showed the comparison age, GPA, and NSAR using sensitivity (Type I error) and 1- specificity (Type II error) to the diagonal line of no discrimination. The AUC above the diagonal line graphically depicted the strength or predictive usefulness of the variable over the random match of 0.50 for the dichotomous outcome. The lines for GPA and NSAR lie above the diagonal line indicating that their inclusion in the model improved the model's fit. Table 7 documents that the inclusion of NSAR increased the AUC by 0.030, $p = 0.011$ and GPA increased the AUC by 0.272, $p = 0.000$. Accordingly, both NSAR and GPA showed statistically significant improvement in the model fit at the 0.05 level of significance.

Age, while shown to be statistically significant based on the Wald statistic, reduced model fit (AUC = 0.008, $p = 0.513$, 95% CI [0.470, 0.515]). The 95% confidence interval for the AUC for age included the critical value of 0.50 in the range. The Wald statistic's significance of 0.038, and the critical AUC value of 0.50 lying inside the confidence interval indicated that age explained some of the variation in retention.

Table 7

Receiver Operating Characteristics (ROC) Output

Variable	AUC	*SE*	Sig.
Age	.492	.012	.513
NSAR	.530	.012	.011*
GPA	.727	.010	.000*

Note. Exp*(ß)* = exponentiated Beta; AUC = Area under the curve; NSAR = New Student Advising and Registration.
*$p < .05$.

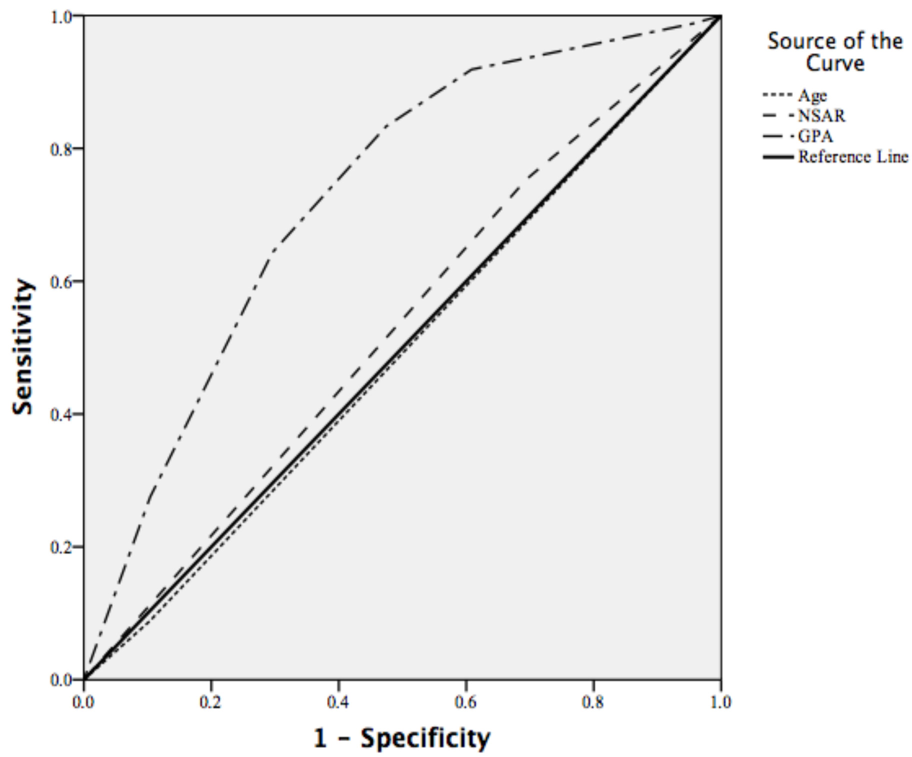

Figure 1. ROC curve. The area under the curve (AUC) indicated the level of discrimination associated with the graphed variable and predicted retention. GPA with an AUC of 0.727 showed the strongest correlation. NSAR completion's AUC of 0.530 was slightly more accurate fit than chance, indicated by the reference line. Age was less accurate than chance.

Analysis of new student advising and registration. The determination of the correlation between NSAR completion and retention for cohort students required additional analysis. NSAR status resulted in a Wald statistic = 4.664, $p = 0.031$, $\exp(\beta)_{\mathrm{NSAR}}(1, N = 2588) = 0.802$, 95% CI [0.657, 0.980]. The 95% confidence interval approached odds of 1:1 or no correlation between NSAR and Retention.

The model predicted value considering NSAR with all other variables constant was 0.928 ($\beta_{\mathrm{constant}} + \beta_{\mathrm{NSAR1}} = 1.148 - 2.20$), $\exp(\beta)_{\mathrm{NSAR1}} = 2.529$ ($e^{0.928}$), 95% CI [2.071, 3.089]. The probability of a student completing NSAR and returning to the CCC holding all other variables constant was 0.717 ($e^{0.928}$ / (1 + $e^{0.928}$)) with a 95% CI [0.674, 0.755]. Students who completed NSAR, ceteris paribus, had a 0.283 probability of not returning to the CCC. In conclusion, the probability of returning based on only NSAR completion status of 0.717 exceeded the average retention rate for all students over the three-year period of 0.587, a 22% difference.

Computing the binary logistic regression focusing on the students who did not complete NSAR resulted in a different constant, no changes in the test statistics, and no changes in the regression coefficients for the remaining variables. The Beta coefficient, shown in Table 8, for students who did not complete NSAR and returned to the CCC, holding all other variables, constant was 1.148 ($\beta_{constant} + \beta_{Not\_NSAR1} = 0.220 + 0.928$) and $\exp(\beta)_{\mathrm{Not\_NSAR1}}$ was 3.152, 95% CI [2.583, 3.850]. The probability of a student not completing NSAR and returning to the CCC, ceteris paribus, was 0.759 ($e^{1.148}$/ (1 + $e^{1.148}$) with a 95% CI [0.721, 0.794]. Students who did not complete NSAR had a 0.241 probability of not returning to the CCC. Therefore, probability of a student completing NSAR (NSAR = 1) and returning to the CCC was 0.042 (0.717-0.759) less than the probability of a student that did not complete NSAR (NSAR = 0) returning to the CCC.

The comparison of the model results for students who did and did not complete NSAR provided insights into the correlation between the NSAR program and retention growth, one of the initiative's goals. Comparing the probabilities indicated that students who did not complete NSAR, ceteris paribus, had a probability of retention of 0.759 that exceeded the probability of 0.717 for students that did complete NSAR. As shown in

Figure 2, the 95% confidence intervals for the probability of retention for the students who did not complete NSAR and students who did complete NSAR overlap, ceteris paribus. Therefore, the model did not confirm that NSAR participation changed a student's probability of returning to the CCC for the following fall semester.

Table 8

Regression Output Not–NSAR

	ß	*SE*	Wald	*df*	Sig.	Exp(*ß*)
Not–NSAR(1)	.220	.102	4.664	1	.031*	1.246
Constant	.928	.327	8.038	1	.005*	2.529

Note. Exp(*ß*) = exponentiated Beta; Not–NSAR = did not complete New Student Advising and Registration.
*$p < .05$.

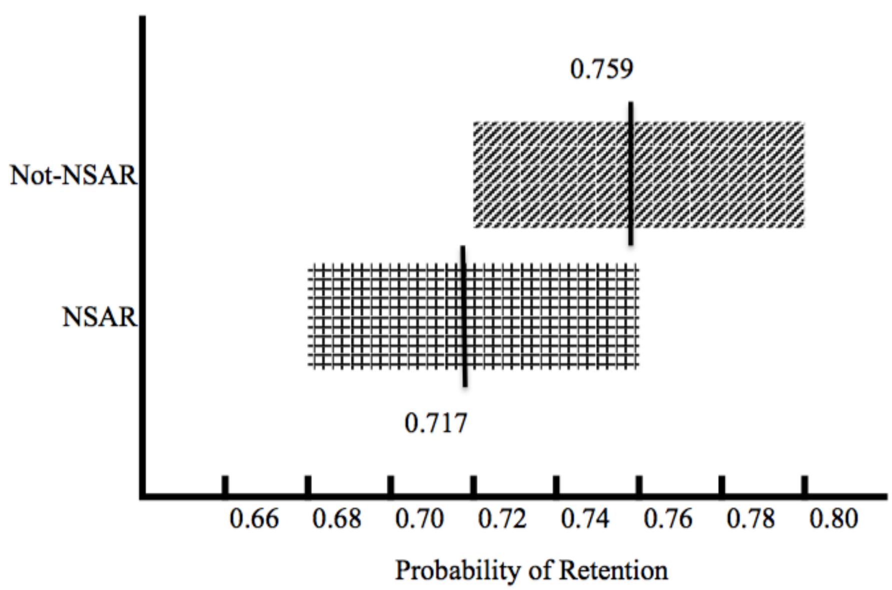

Figure 2. Probability of retention 95% confidence interval.

Outliers and extreme cases. The regression output indicated that three students, approximately 0.1% of the population, showed absolute values of the standardized residuals greater than two standard deviations. Students 190, 1677, 2493 were potential outliers. The identified students were similar because they were each academically prepared for college, earned GPAs above 2.5, and returned to the CCC for the following fall. There was no clear evidence of mistakes in coding their information or other errors.

Removing the three cases and recalculating the binary regression with 2,555 cases resulted in small changes to the statistical output. The new model predicted the same percentage of retention cases, 70.8%. The values for $R^2_{Cox\ \&\ Snell} = 0.173$ and $R^2_{Nagelkerke} = 0.233$ did not change with the cases removed. The Hosmer and Lemeshow test value deteriorated slightly from $\chi^2_{HL}(8, N = 2558) = 0.937$ to $\chi^2_{HL}(8, N = 2555) = 0.919$ indicating that the revised model fit the data set less perfectly as showed in Table 2. Therefore, the model with the three-outlier cases included provided a better fit for the analysis of the correlation between student attributes and retention.

A graphical test for the identification of possible outliers or unexplained variance included graphing the change in deviance against the predicted probability of retention. The graph, shown in Figure 3, indicates two distinct curvilinear patterns. The curve beginning near the origin and increasing to the right depicted the pattern for students who did not return to the college (retention = 0). The second curve indicated the pattern for students who re-enrolled at the CCC for the following fall semester (retention = 1). All data points appear to lie on one of the curves graphically depicting the absence of outliers in the data.

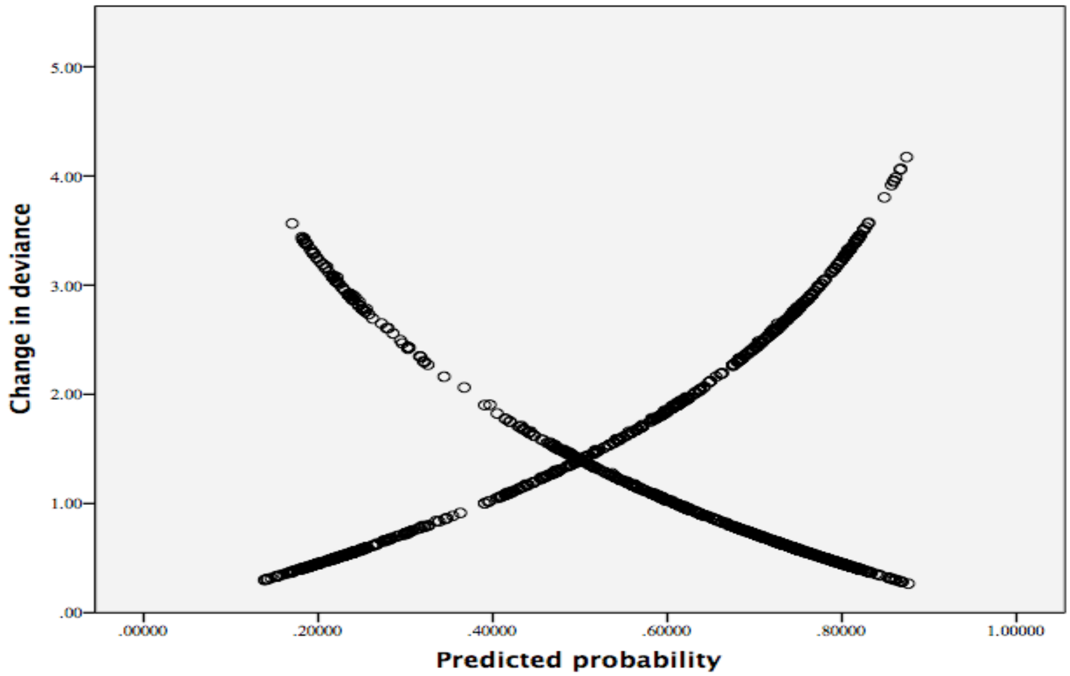

Figure 3. Change in deviance. All points lie close to the asymptotic curves indicating that it is unlikely that outliers or special cases influenced the model.

The graph of Cook's differences depicted a different pattern of potential outliers. Figure 4 showed the relationship between the Analog of Cook's influence and the predicted probability of retention. The curve included the beginning of the dual curvilinear pattern found in Figure 3. The Cook's differences showed that many of the data points do not lie on either of the expected curves. The large number of data points away from the expected curves indicated that other, unidentified variables might correlate with retention. Therefore, the overall model fit might be improved if additional variables are identified, measured, and added to the modeling.

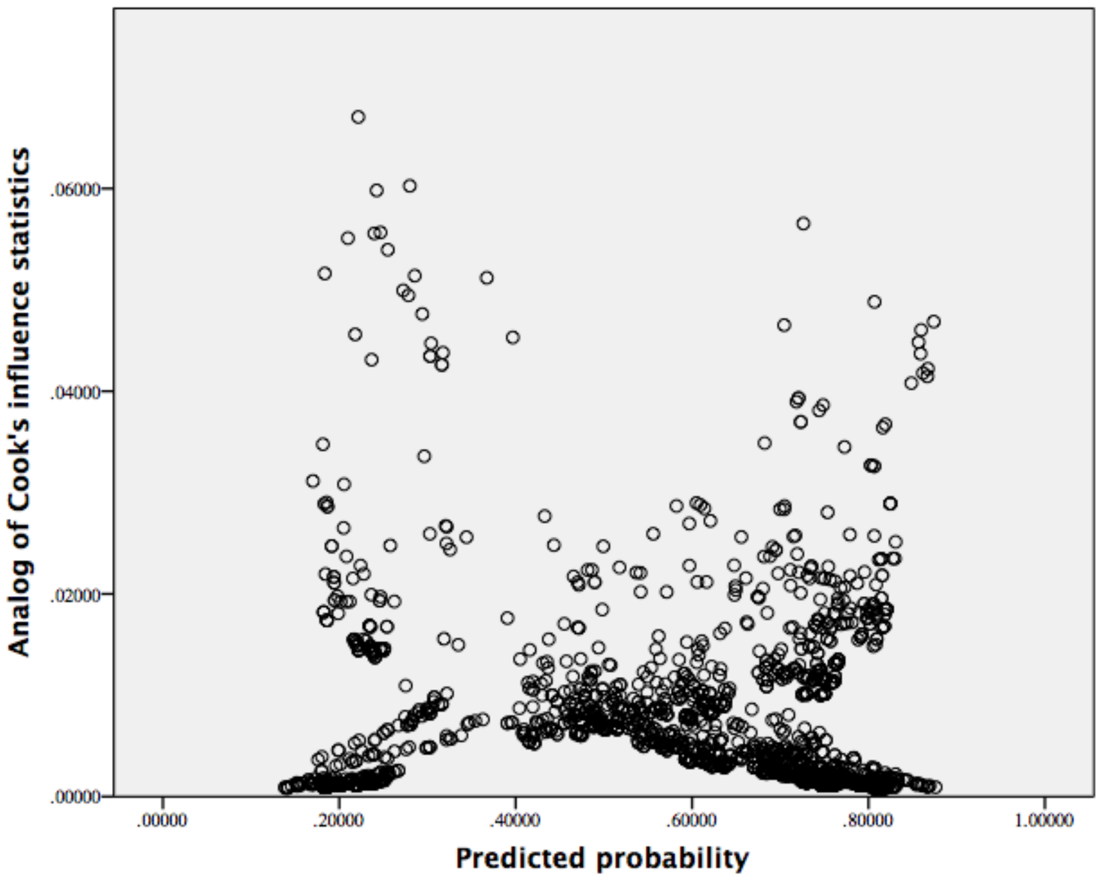

Figure 4. Cook's distances. The expected asymptotic curves do not hold their shape indicating the existence of outliers, leverage points, or unaccounted for variables influencing retention.

Providing decision-makers with data driven information regarding obtained outcomes provides managers with information to build their valence, instrumentality, and expectancy values based on Vroom's VIE theory. Having better estimates of potential outcomes and effort combinations supports improved decision-making (Vroom, 1984). Based on Tinto's 2005 interactionist theory, the modeling included five student demographic variables that often correlate with student retention. The attributes of age, ethnicity, gender, socioeconomic group, and academic readiness are recorded by institutions using national definitions, and reported to the U.S. government (NCES, 2014b). The consistently available variables have been shown to correlate with retention, progression, and graduation in a number of studies including Clark and Cundiff (2011), Hartley (2013), and Tinto (2012).

In the analysis of the strategic implementation of NSAR, many of the predicted correlations were not supported by the data. In the control variable step, enrollment year, age, and socioeconomic group did not have statistically significant correlations with retention. In addition, the model with all variables showed that enrollment year, ethnicity, gender, socioeconomic group, and academic readiness were not correlated with retention at the 0.05 significance level. In the full model, age, NSAR, and GPA showed statistically significant correlations with retention. The 95% confidence intervals overlapped for the probability of NSAR student and not-NSAR student retention, ceteris paribus. The absence of statistical significance between enrollment year, ethnicity, gender, socioeconomic group, and retention was not explained by the analysis. Further research might provide insights on other student demographic attributes that correlate with retention.

Financial Analysis

The planned analysis of the changes in financial results for the CCC included computing the cost-benefit ratio and the cost-effectiveness ratio for offering NSAR, the strategic initiative designed to improve retention, progression, and graduation rates. The review of the statistical findings in the binary logistic regression documented that the odds of students who completed NSAR returning to the CCC for the following fall semester were less than the odds for not-NSAR completers returning. NSAR completers had a probability of returning of 0.717 while not-NSAR completers had a probability of returning of 0.759, ceteris paribus. The decrease in the probability of retention rate of 0.042 applied to the population of 1,865 NSAR completers predicted a loss of 79 enrolled students. Offering NSAR might have reduced retention over the three cohort years by 79 students.

The overlapping 95% confidence intervals, shown in Figure 2, indicated that the probability of returning for NSAR students might exceed the probability for not-NSAR students, ceteris paribus. Thus, a change in revenue pattern cannot be estimated due to the lack of clear evidence of a difference in correlation between NSAR and not-NSAR students with retention. The cost-benefit ratio and cost-effectiveness ratio could not be computed without a clear change in the number of students retained.

In conclusion, the analysis of the effectiveness of the implemented strategic decision documented the correlation between student attributes, including NSAR completion, and retention at the CCC. Based on the literature review, eight predictor variables were considered in the binary logistic regression. The student attributes of enrollment year, ethnicity, gender, socioeconomic group, and academic readiness were not statistically significant. Age, NSAR completion, and GPA were statistically significant in the model. The analysis of this data set showed that offering NSAR correlated with retention, the desired outcome. Further research might identify additional variables that interplay with NSAR and indicate options for enhancing NSAR's design. Analysis of the statistical information did not support the conclusion that the strategic initiative, NSAR, correlated with a difference in the probability of retention or the CCC's financial position. The probability of retention for NSAR students and the probability for not-NSAR students might be equal. The lack of clear evidence of a difference in retention eliminated the possible analysis of changes in revenue associated with the difference in odds of retention between NSAR and not-NSAR students.

Applications to Professional Practice

A correlation existed between student attributes and retention, one of the desired outcomes of an implemented strategic initiative. The analysis of the data set did not support the conclusion that the probability of retention for students who completed NSAR was greater than for students who did not complete NSAR. The inconclusive results might result from potential documentation gaps. Therefore, the CCC's continued allocation of funding for the NSAR program to grow retention was not supported by the quantitative findings. Further review of NSAR's design, implementation, and assessment standards, analysis using additional variables, or qualitative factors might justify the continued funding of NSAR.

Understanding the effectiveness of the CCC's resource allocation decision might improve with better documentation of NSAR participation. It is possible that students were miscoded as NSAR participants because they registered online without completing NSAR. Additionally, students might have completed all but the online registration step in NSAR. The students who almost completed NSAR might not be statistically different from students who registered online at the end of NSAR.

The regression model showed that NSAR participation was correlated with retention with an $\exp(\beta)_{\mathrm{NSAR}}(1, N = 2588) = 0.802$, 95% CI [0.657, 0.980]. The odds of a NSAR student returning to the college for the following fall semester were 0.802:1. Evaluating additional student attributes such as first-generation status or environmental factors such as the local unemployment rate might highlight areas for improvement in NSAR's design. The NSAR team might implement enhancements in NSAR's design that would improve the odds to greater than 1:1 for future cohorts.

The designers of NSAR sought improvement in the CCC's retention, progression, and graduation rates. The desired outcomes might conflict or produce unintended consequences. The NSAR's emphasis on progression toward a degree or graduation might negatively correlate with a student's first year retention decision. After completing NSAR, students might conclude that their goal is not the completion of the degree or certificate program resulting in a decline in retention.

The evaluation of NSAR's affect on student progression toward completion of a degree or certificate requires measuring progression. Current data collection processes at the CCC do not capture progression data for all students. The evaluation of NSAR's correlation with progression requires consistent gathering of timely data.

Determining the correlation between student attributes, including NSAR, and graduation requires additional time. U.S. data collection standards compute graduation rates using 150% of the standard completion time or three years for an Associate's degree (Student Right-to-Know and Campus Security Act, 1990). NSAR's initial year's 150% graduation rate year is spring 2015. The graduation rate information for the CCC for

2015 is not yet available. Improved metrics and a longer analysis timeframe might provide additional insights into the effectiveness of NSAR with respect to the three goals of improved retention, progression, and graduation rates. Therefore, judging the effectiveness of the NSAR program based on the single outcome of retention might omit possible strong correlations associated with progression or graduation rates.

As society refocuses public funding formulas toward efficiency-based methods, administrators' decision-making aims for the greatest positive outcome at the lowest cost (Sexton et al., 2012). Decision-makers that used VEE analysis of program success might place more importance on attaining stakeholder goals over possibly conflicting organizational goals (Luskin & Ho, 2013). Decision-makers need access to timely and accurate information on the effectiveness of allocated resources to maximize their organization's outcomes (Bryson et al., 2011). Planned, statistical analysis of outcome metrics for implemented strategies might improve organizational decision-making. The analysis of the initial three years of the NSAR initiative and retention did not document improvement in retention outcomes. Finally, enhancements to NSAR's design or qualitative aspects might justify continued funding of the program.

Using the binary logistic regression protocol in a planned analysis of initiative outcomes documented the importance of planning program review protocols before the policy is implemented. Data driven analysis might aid program manager's consideration of newly identified attributes in their continuous improvement process for implemented strategic decisions. Three possible gains from more informed decision-making are more accurate prediction of outcome probabilities, greater sensitivity in determining outcome instrumentality, and a larger positive valence (Vroom, 1984). The evaluation of implemented strategic initiatives with yes/no outcomes can be evaluated using the studied model if the institution retains accurate and timely metrics.

Implications for Social Change

A community's financial wealth and physical well-being improves as students complete their college educations (Grubb, 2002a). The analysis of this study's data indicated that the modeled odds of a NSAR student returning to the CCC for the following fall semester were less than 1:1. The impact of the implemented strategic initiative on student retention decisions might be zero because the modeled probability of retention for NSAR and not-NSAR students, ceteris paribus, had overlapping 95% confidence intervals. The modeling did not consider student goal attainment that might differ from returning to the CCC for the following fall semester.

As more students complete college credentials, the educational attainment and wealth of future generations also increases (Zhan & Sherraden, 2011). Growth in student academic success evidenced by improvements in retention rates at the CCC could result in improved financial outcomes for the college, the students, their families, and the community. The documentation of the correlation between a strategic program and student academic decisions using binary regression determined that an analysis of dichotomous outcomes is feasible, and that possible changes in included variables or better metrics might enhance the analysis.

Recommendations for Action

This analysis modeled the correlation between student attributes, including NSAR completion, and retention. A planned assessment of strategic initiative outcomes should include predetermined data collection and evaluation metrics and schedules. A potential weakness of the NSAR program is the possible adverse interactions between the three desired outcomes of improving retention, progression, and graduation rates. The inclusion of clear, measurable outcomes might facilitate the evaluation process. The understanding of the financial implications of resource allocation decisions might improve with the use of qualitative and quantitative analytical techniques. The adoption of binary logistic regression along with cost-benefit and cost-effectiveness ratios provides easy to quantify metrics for evaluating the outcomes of a dichotomous variable. Decision-makers could improve the evaluation of decisions by considering the quantitative analysis of program outcomes before extending a program or implementing similar initiatives.

Better decisions might result with the knowledge of actual outcomes in addition to administrator's perception of the outcomes. Individuals responsible for program operations could use the quantified analysis of outcomes in determining the current success rate for their program, and evaluating the existence other variables leading to program enhancements. Additionally, decision-makers and responsible parties must be trained in assessment, program evaluation, and the use of statistical tools. Understanding the relationship between past resource allocations and the desired outcomes might improve future resource allocations leading to improved financial outcomes. The findings from this study might improve resource allocation decision-making supporting gains in student educational outcomes supporting increases in society's labor productivity, income growth, and improved quality of life. This information could help college administrations make more informed resource allocation decisions, improve organizational accountability, and garner additional public funding under performance based funding algorithms.

Recommendations for Further Study

The regression model with student demographic variables, NSAR, and GPA resulted in correctly matching 70.8% of the observed retention points. Three variables, age, GPA, and NSAR had statistically significant odds ratios with retention. Also, the Cook's distances graph, Figure 4, showed that a large number of data points did not lie on one of the two expected curvilinear lines. It appears that other, unknown student attributes or environmental factors correlate with student retention decision-making. The inclusion of additional attributes such as student academic goals, having a declared major, participation in service-learning projects, one-on-one relationships with faculty or staff members, and online learning programs might strengthen the model's fit. Additional research might consider the correlation of environmental factors such as unemployment rates, availability of employer funded educational assistance, and the business sector demand for certificate or degree credentials with retention.

Further study might resolve the limitations associated with the current analysis of the strategic initiative. The data set included all members of the NCES tracked fall semester first-time–full-time student cohorts. FT-FT students might have different decision-making processes from other student groups including students enrolled at more than one institution, transfer students, and part-time students. Conducting the analysis with data points for the entire population of new students might result in a different regression model. Further, NSAR design elements might be more effective at encouraging retention among different student cohorts. The CCC might need additional staffing or technology to gather and manage the larger data set. Repeating the analysis each fall and spring semester with data for all newly enrolled students might provide a more timely and complete analysis of program outcomes.

Students are strongly encouraged to complete NSAR. Each student's NSAR experience might be different based on the combination of faculty, staff, and students working during the session. An analysis of outcomes based on NSAR session staffing might identify opportunities for improvement. Additionally, the closeness in time between attending NSAR and the start of the semester might influence the correlation with retention. Limitations on course or section availability close to the semester start might influence a student's retention decision more than their participation in NSAR. Overcoming the challenge of matching a student's course selection with their program needs when few seats are available close to the start of the semester is not within NSAR's control.

The analysis of the changes in revenues and costs associated with the strategic initiative could identify possible interactions among outcome goals. NSAR's stated goals might conflict with each other. An additional study might aid in the identification and measurement of these interactions. Lastly, understanding the possible conflict between student goals and the organization's goals might provide insights into the correlation between NSAR participation and retention.

Reflections

Resource allocation decision-making requires careful consideration of the advantages and disadvantages of available alternative activities. Predetermined review procedures incorporated into the planning process might support improvements in resource allocation decision-making. I was surprised that the CCC's implementation design for NSAR did not include methods for capturing output metrics designed to assess the overall effectiveness of NSAR or support program enhancements. I continue to believe that creating assessment plans in advance improves assessment and decision-making. On reflection, I recognize that some prefer to work with different forms of accountability and program review. In this case, organizational culture played an important role in the design, implementation, and ongoing evaluation of the NSAR program.

Summary and Study Conclusions

The hierarchical binary regression model for student attributes with participation in NSAR showed a correlation with retention. Students who completed NSAR, a strategic initiative, were expected to return to the college at a rate more than 70%, exceeding the average retention rate of less than 60%, but within the 95% confidence interval for not-NSAR students. The allocation of resources for operating NSAR did correlate with growth in the retention rate for FT-FT students at the college. Further study using all students and additional student or environmental attributes might demonstrate a stronger correlation between NSAR participation and retention. Evaluating NSAR based on its three objectives of growing retention, progression, and graduation rates might show outcome improvements and support the calculation of the cost-benefit ratio and cost-effectiveness ratio. Additionally, the analysis of outcomes using a different combination of variables might provide decision-makers with a more accurate assessment of implemented decisions and support future strategic decision-making.

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Appendix A: Variables

Predictor								Criterion
Control Variables: Student Demographics						Start of College	College Outcome	
Enrollment Year, Fall Semester	Age	Race/ethnicity	Gender	Socio-economic group	Academic Readiness	NSAR	GPA after first semester	Retention
Categorical	Categorical	Categorical	Categorical	Categorical	Categorical	Categorical	Categorical	Categorical
polytomous	dichotomus	polytomous	dichotomus	dichotomus	dichotomus	dichotomus	polytomous	dichotomus
1 = 2011	0 = 24 and under	0 = other	0 = male	0 = received financial aid	0 = enrolled at least one develpmental class	0 = did not register online	0 if GPA blank	0 = did not enroll in second fall
2 = 2012	1 = over 24	1 = Caucasian	1 = female	1 = did not receive financial aid	1 = enrolled in no developmental class	1 = registerd online	1 if GPA < 0.5	1 = enrolled in second fall
3 = 2013		2 = African American					2 if 0.5 ≤ GPA < 1.50	
		3 = Hispanic					3 if 1.50 ≤ GPA < 2.5	
		4 = Multiple Races					4 if 2.5 ≤ GPA < 3.5	
							5 if 3.5 ≤ GPA	

Appendix B: Site Agreement

Community College [redacted]

Anne Williams
[redacted]

April 16, 2015

Dear Anne Williams,

Based on my review of your research proposal, I give permission for you to conduct the study entitled Evaluating a Strategic Initiative's Efficiency to Enhance Community College Financial Sustainability within [redacted] Community College. As part of this study, I authorize you to obtain a Limited Data Set including Depersonalized NCES First-Time–Full-Time student records for fall 2011, fall 2012, and fall 2013 cohorts including enrollment year, age, ethnicity, gender, financial aid status, placement in developmental course, New Student Advising and Registration completion status, first year total credits earned, first year GPA, and first year retention status (re-enrollment status for the following fall semester). Additional records include financial records indicating costs of operating New Student Advising and Registration including allocated and unallocated expenses for assigned staff, supplies, and overhead, and revenue per student for tuition, fees, state funding allocation, bookstore, and other vendors. No contact will occur between Anne Williams, the researcher, and students of Gateway Community College for the purposes of obtaining information for the research project. The researcher will continue in the role of Professor of Business at the college.

We understand that our organization's responsibilities include: providing the depersonalized Limited Data Set. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting and that this plan complies with the organization's policies.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty/staff without permission from the Walden University IRB.

Sincerely,

[redacted]
President

Appendix C: Data Use Agreement

DATA USE AGREEMENT

This Data Use Agreement ("Agreement"), effective as of April 16, 2015 ("Effective Date"), is entered into by and between Anne Williams ("Data Recipient") and [redacted] Community College ("Data Provider"). The purpose of this Agreement is to provide Data Recipient with access to a Limited Data Set ("LDS") for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.

2. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient a LDS in accord with any applicable HIPAA or FERPA Regulations

3. Data Fields in the LDS. No direct identifiers such as names may be included in the Limited Data Set (LDS). In preparing the LDS, Data Provider shall include the **data fields specified as follows**, which are the minimum necessary to accomplish the research (list all data to be provided): Depersonalized NCES First-Time-Full-Time student records for fall 2011, fall 2012, and fall 2013 cohorts including enrollment year, age, ethnicity, gender, financial aid status, placement in developmental course, New Student Advising and Registration completion status, first year total credits earned, first year GPA, and first year retention status (re-enrollment status for the following fall semester). Additional records include financial records indicating costs of operating New Student Advising and Registration including allocated and unallocated expenses for assigned staff, supplies, and overhead, and revenue per student for tuition, fees, state funding allocation, bookstore, and other vendors.

4. Responsibilities of Data Recipient. Data Recipient agrees to:

   a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

   b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

   c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

   d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

5. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its Research activities only.

6. Term and Termination.

a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

7. Miscellaneous.

a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER	DATA RECIPIENT
Signed: [redacted]	Signed: Anne A Williams
Print Name: [redacted]	Print Name: Anne Williams
Print Title: President	Print Title: DBA Candidate