2013

The intersection of social capital and finances on intentions to transfer in STEM fields: A study of community college students in a rural midwestern state

Tracy L. Kruse
Iowa State University

The intersection of social capital and finances on intentions to transfer in STEM fields: A study of community college students in a rural midwestern state

by

Tracy L. Kruse

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Education (Educational Leadership)

Program of Study Committee:
Soko Starobin, Major Professor
Sharon Drake
Larry Ebbers
Frankie Santos Laanan
Mack Shelley

Iowa State University

Ames, Iowa

2013

Dedication

This is dedicated to my family. To my husband, Dan—without your never-ending support, love and understanding, finishing this dissertation would not have been possible. To my children, Nolan, Brooklyn, and Delaney—thank you for your patience and understanding for all the times I had to work and couldn't spend as much time with you as I would have liked. I hope that you have gained from me a desire to keep on learning and a persistence to see things through to their completion. To my parents, Deb and Gary—thank you for instilling in me the importance of higher education. I would not be where I was at today without your support and encouragement to follow my dreams. I love you all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

This journey has been a roller coaster ride with many ups and downs, and I can tell you that I would not be where I am at today with the support of many individuals along the way.

To my major advisor, Dr. Soko Starobin, you truly are my mentor. Thank you for taking me under your wings and allowing me the opportunity to join your research team. This experience has taught me greatly, and I know I have learned so much under your tutelage. I also want to thank my committee members: Dr. Larry Ebbers, thank you for your extra nudging and encouragement to enter this program and for all your support and assistance you have given me throughout this journey. Dr. Frankie Santos Laanan, thank you for all your guidance and for pushing me to become a true scholar; Dr. Sharon Drake, from the early days in LINC to your Program Assessment and Evaluation course, I have always enjoyed your wisdom, knowledge, and sense of humor; Dr. Mack Shelley, thank you for being my methodologist and really helping my understand structural equation modeling. The extra patience and guidance you gave me these past few months is very much appreciated. My sincere appreciation also goes out to Dr. Anne Foegen who stepped in at the last minute to serve as a substitute on my committee.

To others within the department who have so willingly offered their time and assistance—Judy Weiland, Holly Ryan, Dr. Aurelia Kollasch, and Dr. Marisa Rivera—you ladies are awesome. Thank you for all you do to help make sure we are all successful.

To fellow graduate students, Tushi Baul and April Chen, thank you for all the work you have done as part of our research team. Words truly cannot express what an important

role you both played on our team. And Tushi, special thanks for your extra assistance in helping me learn SEM. You were there when I really needed someone most.

To Kent Kroeger, Director of Survey & Behavioral Research Services and Coordinator of Statistical Consulting in the Department of Statistics, you have been phenomenal. Your work is outstanding. Thank you for being there at all hours of the night and on weekends as I treaded through the very murky depths of data imputation. I couldn't have done this without you.

I would like to also like to thank my colleagues: Dr. Penny Wills, for encouraging me to enroll in this program and giving me the necessary support and time away from work to help make it happen; secondly, to my colleagues Dr. Wendy Mihm-Herold, Dr. Julie Huiskamp, Dr. Kathleen Nacos-Burds, Curt Oldfield, and others who gave me the courage to try and set an example for me to follow; and finally, to Dr. Michael Chipps, thank you for your extra concern and support in making sure I made it through the final hurdles of this journey.

Last, but certainly not least, thanks to my colleagues in the cohort. Each one of you has added to the richness and depth of this program. I especially want to thank Ryan Anderson, Kip Bottenfield, Jerome Hilscher, Tom Johnson, Bianca Myers, Mark Peltz, and Jennifer Sabourin. You all have truly made a mark in my life. Thank you for all the fun times we had and for all the great memories we shared. This program would not have been the same without all of you.

ABSTRACT

The purpose of this quantitative study was to examine Iowa community college students' intent to transfer to a 4-year institution in a STEM field. Specifically, it examined the demographics of the study participants as well as financial variables, including number of hours worked, number of dependents supported, and amount of financial aid received, to determine if there was any statistical significant differences between the students who did not intend to transfer, those students who did intend to transfer into a non-STEM field and those students who did intend to transfer into a STEM field.

Secondly, this study used exploratory and confirmatory factor analysis and structural equation modeling to identify the factors related to social and cultural capital (i.e., debt aversion, parental involvement, parent education levels, family encouragement, and access to institutional agents), finances (i.e., financial aid and financial concerns), and environmental pull factors (i.e., ability to balance work, home, and school) to determine the relationships among these predictors and their direct and indirect effects on transfer intentions. Cabrera, Nora and Castaneda's (1992, 1993) integrated model of student retention provided the conceptual framework for this research.

Statistically significant differences were found between students who did not intend to transfer and those students who intended to transfer in non-STEM fields and those who intended to transfer in STEM fields. This included differences in ethnicity, age, gender, parent education levels, and number of college math and science courses taken as well as in the amount of financial aid received (scholarships and loans) and their related financial concerns. Contrary to previous research, this study's findings indicated that financial aid (loans, scholarships, and grants) is a negative predictor of intent to transfer into a STEM

field. The final model identified social capital factors related to parental education levels, family encouragement, parent involvement in high school, and access to institutional agents. Debt aversion did play a role in the model, although not a part of social capital as originally hypothesized. Environmental pull factors related to number of hours worked and number of dependents supported was not significant in this study.

CHAPTER 1. INTRODUCTION

Overview

Over the past several decades, the number of students in higher education has grown significantly, from about 9 million students in 1980 to over 20 million in 2011. During this time, no sector of higher education has grown faster than community colleges, with associate's degrees granted growing 50% between the 1999–2000 and 2009–10 academic years (National Center for Education Statistics [NCES], 2011). As more and more students elect to attend the country's network of 2-year institutions and the need for an educated workforce continues to rise, the importance of student degree attainment is even more pronounced (Hagedorn, Moon, Cypers, Maxwell, & Lester, 2006).

The need for an educated workforce, along with economic downturns and global competition, have caused a number of public policy efforts to focus on increasing the number of U.S. adults with postsecondary credentials, and especially in high growth, high wage areas such as science, technology, engineering, and mathematics (STEM) fields (Costello, n.d.). In November 2009, President Obama launched Educate to Innovate, a nationwide effort to help reach the goal of moving American students from the middle to the top of the pack in science and math achievement over the next decade, especially among underrepresented groups, including women and minorities (White House, 2009).

The Bureau of Labor Statistics estimated that STEM occupations would grow by 17%, whereas non-STEM occupations would grow by 9.8%, between 2008 and 2018. Much of this strong growth is attributed to those positions that require less than a baccalaureate education, such as environmental engineering technicians, biological technicians, and computer support specialists (Costello, n.d.).

However, one of the barriers to STEM higher education opportunities is the rising cost of education. Research has shown that students of color and those from low-income backgrounds are disproportionately more likely to attend community colleges and are much less likely to graduate than are other students (Hagedorn et al., 2006). Additionally, women and minorities continue to be underrepresented in STEM fields. Huang, Taddese, and Walter (2000) found that only 26.8% of underrepresented minorities completed a baccalaureate STEM degree within five years as compared to 46% of Caucasian/White and Asian students who initially enrolled in STEM fields.

This is especially troubling at a time when the purchasing power of Pell grants is decreasing, state support is waning, and tuition and fees are skyrocketing, thus creating an opportunity gap for many disadvantaged students who can no longer afford higher education. Ironically, this rising inequality is undermining the very essence of the Pell grant in the first place—to provide everyone with an equal chance at academic and economic success, despite financial need. In fact, one study found that the imbalance between rich and poor children in college completion—the single most important predictor of success in the work force—has grown by about 50% since the late 1980s (M.J. Bailey & Dynarski, 2011).

This opportunity gap is illustrated by the fact that Pell Grants covered about 33% of the total cost of education in 2011, down from 72% in 1973 (J. Friedel, personal communication, September 27, 2012). In addition, the annual *Grapevine* report from Illinois State University and the State Higher Education Executive Officers (Palmer & Franklin, 2011) reported that total state support for higher education declined 7.6% from the 2011 to the 2012 fiscal years and that funding is still now nearly 4% lower than it was in the 2007

fiscal year. In fact, 29 states appropriated less for colleges in 2011 than they did 5 years before (Palmer & Franklin, 2011).

As a result, states have increased their tuition and fees and are asking students and their families to shoulder a larger share of the total cost of an education. By way of illustration, student debt ($870 billion) has overtaken credit card balances ($693 billion) and auto loan debt ($730 billion) in this country, according to a recent Federal Reserve Bank report (Brown, Haughwout, Lee, Mabutas, & Ven der Klaauw, 2012). On average, over the decade from 2001–02 to 2011–12, in-state tuition and fees increased at an annual rate of 5.6% beyond general inflation, and in-state tuition and fees in the public two-year sector rose at an average annual rate of 3.8% beyond general inflation (Palmer & Franklin, 2011).

In addition to the gap between the Pell grant and cost of tuition and fees, the National Association of State Student Grant and Aid Programs (NASSGAP) reported that, although need- and nonneed-based grant aid from the states increased from $8.6 billion to $8.9 billion from 2008–09 to 2009–10, a vast majority (74%) of the need-based aid came from 10 states (California, New York, Texas, Pennsylvania, Illinois, New Jersey, North Carolina, Washington, Indiana, Minnesota), which collectively awarded more than $4.6 billion in undergraduate need-based grant aid. This report demonstrates the vast disparity in finding levels between the states. The average need-based grant per undergraduate, for example, ranged from a high of $1,125 in New Jersey to a low of $3.40 in Georgia (NASSGAP, 2010).

Approximately 54% of all aid provided to students by higher education institutions in this country was merit-based. Of this, approximately 60% went to students whose families earned $60,176 per year or more and only about 20% went to students whose families earned $33,346 or less. Even in the distribution of need-based aid, only 20% of the aid went to the

neediest families (NASSGAP, 2010). This is in spite of the fact that a positive relationship has been found between aid and graduation among low- and medium-income students, but not among high-income students (Bowen, Chingos, & McPherson, 2009).

Aid has been effectively shifted away from low-income students to students from more affluent backgrounds. Nowhere is this more of a problem than in rural areas. Katsinas and Friedel (2010) found that, although enrollment at all college types (rural, suburban, and urban) grew significantly from 2000–01 to 2006–07, the rural sector captured the greatest percentage of growth, comprising 44% of all growth among associate's degree-granting institutions and 57% of all growth among 4-year colleges and universities. A related report by Katsinas Menzel, Hagedorn, Friedel, and D'Amico (2012) illustrates the large number of needy students in rural areas. They reported that, although rural community colleges served 33% of all students in the United States in 2007–08, 39% of all Pell grant recipients came from these colleges. Similarly, they found that these students accounted for 48% of all student debt incurred at community colleges, according to the 2007–2008 Integrated Postsecondary Education Data System Student Financial Aid Cohort Survey.

Due in part to state and federal financial aid policies, the United States continues to fall further behind other countries in degree attainment (Burdman, 2005). America ranks 12th among 36 developed nations in the number of 25- to 34-year-olds with postsecondary attainment (Lee & Rawls, 2010). Specifically in terms of STEM education, the *Rising Above the Gathering Storm* study (Rising Above the Gathering Storm Committee, 2007) indicated that in the United States 15% of all undergraduates received their degrees in natural science or engineering, compared to 38% in South Korea, 47% in France, 50% in China and 67% in Singapore.

If the United States wants to regain its status a leader in the global marketplace where STEM-related skills are a necessity, it must first retain the students who every year enter college and declare a STEM major. In the last decade, very little data have been collected on the completion, retention, and graduation rates of STEM students, especially students transferring from community colleges to 4-year institutions. However, two studies conducted on the topic both found that STEM students complete degrees at a much lower rate than do non-STEM students, even when given 5 years to complete the degree (Scott, Tolson, & Huang, 2009; Whalen & Shelley, 2010).

State of Iowa Perspective

U.S. Secretary of Education Arne Duncan's remarks at a recent Iowa Education Summit, citing Iowa's stagnant student performance as key indicators, served as a wake-up call for many of the state's educational leaders (U.S. Department of Education, 2011). Iowa is the only state in the nation, he said, that hasn't made significant progress in eighth grade math since 1992. More recently, since 2003, only one state has had less student growth than Iowa on the National Assessment of Education Progress (NAEP) math assessment. Of the 12 midwestern states, Iowa has the fourth-lowest percentage of people with a bachelor's degree (25%), and, even worse, the state now falls behind 33 nations and provinces and 20 other U.S. states in producing students with advanced levels of math. Countries like Slovenia, Estonia, Slovakia, Poland, and Lithuania produce a higher proportion of advanced math students across the entire student population than the Iowa school system does among its White students alone (U.S. Department of Education, 2011).

As a result, Iowa Governor Terry Branstad called together a statewide collection of educators, business professionals, scientists, consultants, government officials, and others in

an effort to develop a comprehensive plan for STEM education enrichment in the state. In response, they developed the 2011 Iowa STEM Education Roadmap. As part of this plan, Iowa has been developing some bold initiatives that will, among other things, (a) produce increased interest and performance of Iowa learners in STEM fields (including females and minorities) and (b) develop increased emphasis on STEM educational opportunities from pre-K through 20 (Iowa Math Science Education Partnership, 2011).

In addition, the governor has established a statewide STEM advisory council as well as six regional STEM networks to promote STEM education and economic development in communities across Iowa (Office of the Governor of Iowa, 2011). It is clear through these initiatives that community colleges play an eminent role in the increase of STEM secondary and postsecondary education opportunities statewide.

However, one of the barriers to STEM higher education opportunities in Iowa is the rising cost of education. In ranking 4-year private colleges and public universities nationwide, the Project on Student Debt (2011) reported an alarming fact: that Iowa students graduated with the third-highest educational debt ($29,598) and the state ranked fourth in terms of the percentage of students with debt (72%). Furthermore, it is disheartening that, even though community colleges in Iowa provide education at a much more reasonable cost in comparison to its 4-year public counterparts, Iowa's community college tuition and fees are still among the highest (eighth) compared to their peers nationally (Washington Higher Education Coordinating Board, 2010).

Part of the reason for these increased costs is the state's decreased investment in public higher education. According to the Iowa Policy Project, between fiscal years 2000 and 2011 appropriations decreased nearly 40% for Iowa's three public universities, after

accounting for inflation (Cannon, 2012a). Community colleges were no exception to these funding woes, with their funding decreasing by 21% over the same period (Cannon, 2012b). To make up for lost state support, Iowa's community colleges and public 4-year universities have asked students and their families to cover a larger share of the total operating costs.

Not only has the decrease in state funding put pressure on Iowans' family budgets, but a lack of increase for state and federal student aid has created a serious financial burden for students and the families of those pursuing postsecondary education. In 2009–10, Iowa ranked 34th in the amount of state grant dollars per full-time equivalent undergraduate ($244.59) and 44th in terms of percentage of total students receiving grant awards (9.9%). This compares to a ranking of 12th ($378.86) and 28th (13.97%) in 2001–02. In terms of federal support, the maximum Pell grant in 2001–02 was $4,000 and the estimated cost of attending one of the public 4-year universities for a resident undergraduate, for example, was about $11,000, leaving a gap of $7,000. Last year, the maximum Pell had increased to $5,550, but the cost of attending school had risen to an estimated $18,900, resulting in an increased gap of about $13,350 (Krapfl, 2012). In other words, the difference between tuition and state and federal support has widened at an alarming pace.

A recent report from the Iowa College Student Aid Commission (2010b) highlighted the serious nature of this problem in the state. Over the past two decades, the average undergraduate tuition and required fees increased 268% at Iowa's public 4-year universities, 196% at Iowa's private nonprofit 4-year colleges, and 209% at Iowa's community colleges, compared to increases of 93% in Iowa's median income and 62% in state financial aid appropriations over the same time period. Today, published college costs take up a higher percentage of household income, especially considering that median household income for

many Iowa aid recipients is lower than the median household income in Iowa (Iowa College Student Aid Commission, 2010b). Iowa's 2009 median household income of $48,065 falls just below the national median household income of $50,221 (Iowa Workforce Development, 2011). Compounding this problem is the fact that Iowa ranks first in the nation in the number of children age 6 years and under (75.6%) in which all parents are in the labor force (French, Fisher, & O'Connor, 2011).

Statement of the Problem

In the United States generally and in Iowa specifically, initiatives are underway that focus on STEM education, but they are inconsistently resourced and lack purview beyond discrete stakeholder groups. Equal opportunities in STEM are not available to all learners, especially in rural districts and socioeconomically challenged regions (Schenk et al., 2012). Females and students of underrepresented ethnic and racial minorities, in particular, enroll at disproportionately low rates in STEM courses and enrichment activities. (Laanan, 2003; Starobin, Laanan, & Burger, 2010).

Given the high cost of education and the limited availability of state and federal need-based grants, the opportunity gap between advantaged and disadvantaged students only continues to grow. Furthermore, the number of minority students on college campuses continues to rise and is expected to outnumber the number of Whites by the year 2020 (Prescott, 2008). This is especially concerning in Iowa due to its increasingly diverse K–12 population. The number of minority students in the state is at an all-time high (86,512) and now make up 18.5% of the student body (Iowa Department of Education, 2011a).

It is clear that if Iowa and the rest of the country are to make strong gains in the number of postsecondary STEM degrees earned, they will need to focus more on these

minority and disadvantaged students (Starobin et al., 2010). Unfortunately, these students are also most often financially insecure and unable to afford the rising costs of tuition. A report from the College Board (Baum & Ma, 2011) indicated that the median income for Black and Hispanic families was less than 60% of the median income for White families. Even more shocking is that the poorest 20% of families actually make 7% less after inflation than what they did in1980.

Secretary Duncan called on Iowans to transform their education system, stating that education is the great equalizer and that "enhancing education for all—and not just for some—is the key to Iowa's future economic prosperity" (U.S. Department of Education, 2011, para. 77). Ultimately if the state of Iowa is to respond to the secretary and meet the governor's STEM goals by increasing the pipeline of students in higher education, it needs to better understand the students who are enrolled in STEM programs at community colleges, their degree aspirations, and the financial barriers that make transfer difficult for these students.

Purpose of Study

According to Starobin et al. (2010), the influences of academic success among students in STEM fields at community colleges have not been thoroughly explored. Given the large number of rural students in community colleges and the setting and demographics of this current study within Iowa, this study adds to the knowledge about the unique factors that influence the postsecondary success of rural students in community colleges. Specifically, this research is aimed at (a) understanding the demographic, financial, and social capital characteristics of students attending Iowa's community colleges and their influences on intentions to transfer to a 4-year institution in a STEM field and (b) informing

practitioners and policymakers who are interested in further understanding the factors that make it more difficult for rural, economically disadvantaged students and other at-risk populations to participate in higher education and graduate. By better understanding these factors, steps can begin to be taken to get more of these students into the STEM education pipeline.

This study utilizes data from the STEM Student Success Literacy study, which is part of a multiyear research project entitled, *Measuring Constructs of STEM Student Success Literacy: Community College Students' Self-Efficacy, Social Capital, and Transfer Knowledge*. The SSSL survey instrument measures self-efficacy, social capital, financial literacy, transfer knowledge and general student demographics and provides the necessary information to adequately study this problem.

Research Questions

The research questions this particular study sought to answer are as follows:

1. What are the background and demographic characteristics of the students who participated in the SSSL study?
2. Are there statistically significant differences between demographic variables, such as age, gender, enrollment status, ethnicity, and number of math and science courses taken, between the students who do not intend to transfer and those who intend to transfer into a non-STEM field and those who intend to transfer into a STEM field?
3. Are there statistically significant differences between financial variables, such as number of hours worked, number of dependents supported, and amount of financial aid received, between the students who do not intend to transfer and those

who intend to transfer into a non-STEM field and those who intend to transfer into a STEM field?

4. How do factors related to social/cultural capital (i.e., debt aversion, parental involvement, parent education levels, family encouragement, and access to institutional agents) influence community college students' intention to transfer to a 4-year institution in a STEM field after graduation?
5. How do factors related to students' ability to finance their education as well as environmental pull factors and financial concerns related to enrollment and employment status and support of dependents influence community college students' intention to transfer to a 4-year institution in a STEM field?

Methodological Approach

This study employed a quantitative research methodology using a postpositivist approach, challenging the traditional positivist notion and the absolute truth of knowledge. Postpositivist researchers, as stated by Creswell (2009), cannot be positive about their claims of knowledge when studying the behaviors and actions of humans.

This study attempted to identify and assess the causes that influence the outcome—intent to transfer—through a thorough literature review. These ideas were then reduced to a discrete set of variables and constructs to form the hypotheses and research questions. From there the data were collected and analyzed to either (a) support or (b) reject the hypotheses. Necessary revisions and additional tests were conducted using confirmatory factor analysis (CFA) and structural equation modeling (SEM) techniques.

Conceptual Framework

This study was guided by Cabrera et al.'s (1992, 1993) integrated model of student retention; Nora's (2003) student/institution engagement model; Bourdieu's (1973) social capital theory; and other empirical evidence surrounding finances, financial aid, and debt aversion. In addition to the student persistence framework, the notion of system retention framework was applied using intentions to transfer as a proxy measure for student persistence (Hagedorn & Cepeda, 2004; Hagedorn et al., 2006; Hagedorn, Cypers, & Lester, 2008).

Cabrera et al.'s (1992, 1993) model was first conceptualized based on Tinto's (1975, 1987) student integration theory and Bean's (1982) student attrition model. In an attempt to combine the two models and also address their limitations, Cabrera and associates (1992, 1993) tested a new integrated model of student retention to better explain student persistence. What made this model unique from previous models is that it included both financial attitudes and actual financial aid received in a model, separated academic integration from academic preparation and grade point average (GPA), and included the role of encouragement from family and friends. These were combined with attributes regarding students' motivational and academic preparation and goals along with their institutional experiences to form a more complete picture of student persistence.

Additionally, this study focused on the outside, external factors that make it difficult for community college students to succeed. Nora's (2003) student/institution engagement model offers a basis for exploring the unique interaction between the student and the institution, examining precollege, college, and environmental pull factors related to minority and other at-risk populations. The present study focused specifically in Nora's (2003)

conceptualization of environmental pull factors, or the characteristics that can pull a student away from engagement on campus. These factors include family responsibilities, work responsibilities, and the number of dependents supported.

Due to the very complex nature of a student's decision-making process, preparations for attending a higher education institution, and actual persistence behaviors, it makes sense to study the unique characteristics of community college students and the social and cultural constructs or lens in which those decisions and behaviors are made. For this reason, this study also reconceptualized previous student persistence models to incorporate the social and cultural capital theories.

Social and cultural capital, as defined by Bourdieu (1973), offers a framework for understanding how individuals and organizations interact and relate to one another. Cultural capital offers a common set of subjective perceptions held by all members of the same group or class that shapes the individual's expectations, attitudes, and aspirations, whereas social capital provides them with the appropriate knowledge and social networks to gain access to family members, friends, and institutional agents that are necessary to succeed (McDonough, 1994).

A reluctance to take on debt for higher education is a growing concern among minorities and disadvantaged students (Burdman, 2005; Callender & Jackson, 2005; Chen & DesJardins, 2008; Gladieux & Perna, 2005; J. Kim, DesJardins, & McCall, 2009; Trent, Lee, & Owens-Nicholson, 2006). Many researchers recently have been suggesting that the growing gap in enrollment and college participation is due, in part, to this negative attitude toward debt, especially as college tuition and fees continue to skyrocket. Theorizing that a students' aversion to debt is a learned behavior from their family, friends, and their social

class/culture, this study also incorporated debt aversion into the hypothesized model as part of students' cultural capital. This research helped test this debt aversion theory further, adding to the growing body of literature in this arena.

Finally, Hagedorn and colleagues (Hagedorn & Cepeda, 2004; Hagedorn et al., 2006, 2008) affirmed that a community college student's academic success increases the likelihood of transfer to a 4-year institution and has a positive influence on student retention in postsecondary education. As such, this study conceptualized a student's intent to transfer from a community college to a 4-year institution as student persistence in postsecondary education. This is similar to how Reason (2009) and Starobin, Schenk, Laanan, Rethwisch and Moeller (2012) applied a systems approach to conceptualize student mobility in their studies as well.

In conclusion, although Cabrera et al.'s (1992, 1993) studies were important in reconceptualizing the important role of financial aid and financial attitudes, it is important to note that the studies originated at a 4-year, large, public commuter campus and at a large, southern, urban institution. In both studies, they focused on full-time, first-time freshmen who were U.S. citizens or permanent residents, under the age of 24, and not married. Given that these studies were conducted quite some time ago and focused solely on traditional students attending 4-year institutions, it seemed prudent to refocus these models with today's more diverse community college student in mind. Using more contemporary research focusing on financial impacts, employment, enrollment status, and debt aversion along with recent works utilizing Bourdieu's (1973, 1986) theory of social and cultural capital, this study attempted to modernize previous student persistence models and make it more applicable to the students who attend this nation's community colleges.

Significance of Study

As more and more students attempt to obtain credentials from postsecondary institutions, a way must be found to provide all motivated students with a realistic chance of entering college and becoming a college graduate, despite where they live or what financial resources they have. Considering that over half of all school districts in the United States are located in rural areas and over 20% of the nation's students are located in rural schools (Provasnik et al., 2007), it is prudent to closely examine the factors related to postsecondary enrollment, persistence, and success among students in rural areas.

Additionally, this study provides significant knowledge pertaining to higher education throughout the country, not just in predominantly rural states such as Iowa. For instance, even though Texas is a predominantly urban state with its large cities, it has more rural students than does any other state. In fact, nationally more than 50% of rural students attend school in just 12 states, such as Texas, California, Ohio, Pennsylvania, and Michigan, that tend to be among the most populous and most urban (Strange, Johnson, Showalter, & Klein, 2012).

Finally, issues facing rural education in Iowa are not completely dissimilar to those in other rural states. *Why Rural Matters 2011–2012* (Strange et al., 2012), a national review of rural education with respect to issues of student diversity, socioeconomic challenges, education policy and finance, and education outcomes, rated Iowa's rural schools and students as most similar to rural schools and students in Rhode Island, Ohio, Delaware, Maine, Oklahoma, Nebraska, and Montana.

This study adds to the knowledge base about what influences community college students to transfer to 4-year institutions in STEM fields, including the effect of finances,

social capital, and debt aversion. It provides practitioners with data to help inform their decision-making and provides practical ideas and solutions that may impact student persistence, especially among disadvantaged students. Finally, it also may provide a framework that will help inform policy and future research in the field.

Definitions of Terms

Cultural capital: Transmitted to their offspring, parents value education as a way to maintain class status and continued economic security (McDonough, 1998); the educational, social, and intellectual knowledge that children gain from being a part of highly educated and intellectually sophisticated families (Bourdieu, 1986).

Environmental pull factors: Outside factors, such as family responsibilities and working off campus, that "pull" students away from full social and academic integration on campus and directly influence their ability to succeed in college (Nora, 2003).

Financial impacts: Using the integrated model of student retention model (Cabrera et al., 1992, 1993), financial impacts not only take into account the actual awarding of financial aid (which underscores an objective assessment of the availability of resources), but also incorporates attitudes that reflect students' assessments of the extent to which financial needs are being met not only from financial aid but from other sources as well (i.e., family, jobs, friends).

Intention to transfer: Students' plans to continue their education by moving from a community college and enrolling in courses at a 4-year public or private college or university.

Social capital: The way that parents, teachers, advisors, and peers see and interact with students, which influences students' expectations of themselves, their senses of fit in academic environments, and their future goals (Bourdieu, 1973).

STEM: Science, technology, engineering, and mathematics.

STEM Student Success Literacy (SSSL): This study is part of a multiyear research study entitled, *Measuring Constructs of STEM Student Success Literacy: Community College Students' Self-Efficacy, Social Capital, and Transfer Knowledge*, funded through the College of Human Sciences at Iowa State University with Dr. Starobin serving as Principal Investigator (PI) and Dr. Frankie Santos Laanan and Dr. Daniel Russell as co-PIs. The goal of this study is to ascertain the level of literacy of community college students regarding their transfer readiness for obtaining a baccalaureate degree in STEM fields. The survey instrument used in this study measures self-efficacy, social capital, financial literacy, and general student demographics.

Summary and Outline of Dissertation

The present study examined the implications of rising tuition and the ever-increasing gap between tuition and state and federal need-based aid on the transfer of community college students to 4-year institutions in STEM fields.

Cabrera and colleague's (1992, 1993) integrated model of student retention was further operationalized and its impact on community college student transfer intentions explored. Important practical implications for this investigation exist as institutional officials and student affairs leaders continue to strive to improve success for community college students, especially disadvantaged and minority students, which is a rapidly growing subset

of the population at their institutions. Chapter 2 provides a review of the literature on topics related to student persistence and success. Chapter 3 presents the methodology and research design of the study. Chapter 4 presents the results of the study. Finally, Chapter 5 summarizes the results of the study and presents the discussion, conclusions, implications, and recommendations for future research, policy, and practice.

CHAPTER 2. LITERATURE REVIEW

The purpose of this study was to evaluate the factors that affect student persistence and transfer from a community college to a 4-year institution. This study focused on (a) refining Cabrera et al.'s (1992, 1993) integrated model of student retention using the addition of recent research on social and cultural capital and on debt aversion and (b) adding to the body of research that has examined the changing demographics and needs of community college students, particularly in studying the transfer intentions of low-income and underrepresented minorities in STEM fields.

To help inform this study, the review of literature opens with an overview of higher education in the United States and then looks more specifically at community colleges. Next, it examines the traditional variables viewed in the literature as having an impact on student success such as academic and social integration, past academic performance, and goal commitment, as well as the financial or environmental factors that pull students away from higher education. Finally, the review concludes with an analysis of the literature that relates to social and cultural capital and the ways that students of different races and socioeconomic statuses interact with higher education. This section includes some emerging literature on the role of debt aversion among minority students.

Degree Attainment in the United States

Between academic years 1999–2000 and 2009–10, the number of degrees earned in the United States increased by 50% each for associate's and master's degrees, 33% for bachelor's degrees, and 34% for doctorate degrees. For all levels of degrees in 2009–10, females earned the majority of degrees awarded. Total postsecondary enrollment grew 38%, from 14.8 million students in Fall 1999 to 20.4 million students in Fall 2009. From 1980 to

2011, the gap in the attainment of a bachelor's degree or higher between Whites and Hispanics widened from 17 to 26 percentage points, and the gap between Whites and African Americans widened from 13 to 19 percentage points (NCES, 2011).

Of those who attended 4-year institutions, approximately 58% of first-time, full-time students in fall 2004 completed a bachelor's degree at that institution within 6 years (an increase of three percentage points from the previous decade). Conversely, approximately 30% of first-time, full-time students who enrolled in fall 2007 completed a certificate or associate's degree within 150% of the normal time required to complete such a degree, compared with 31% in the fall 2000 (NCES, 2011). Although college access has increased dramatically over the past several decades, the percentage of students who complete their bachelor's degrees has remained fairly constant. In fact, the national rate of student departure has hovered around 45% for over 100 years (Tinto, 1982, as cited by Braxton, 2000).

Community College Enrollment in the United States

Of the more than 21 million students in higher education in 2011, nearly 8 million attended the nation's 1,132 community colleges. The mean age of students attending community colleges in the United States students was 28 years. Approximately 40% of community college students were under 21 years of age, whereas 45% of students were between 22–39 years of age and 15% were 40 years of age or older. A majority of all community college students are female (57%) and Caucasian (54%). Hispanic and African American students make up 16% and 14%, respectively, whereas Asian/Pacific Islanders account for 6%, Native American make up 1%, and 10% are other/unknown (American Association of Community Colleges, 2012).

The majority of students (58%) attend college part time and are forced to work part time (47%) or full time (40%) to fund their education. Many students also are forced to rely on outside funding to attend college. In 2008, approximately 46% of all community college students received some sort of financial assistance. About 21% received federal grants, whereas others accessed state aid (13%), institutional aid (11%), and federal loans (10%) (American Association of Community Colleges, 2012).

Although America's community colleges conferred over one million degrees, certificates, or diplomas in 2009, there are many more students who never receive a degree. According to the American Association of Community Colleges (2012), only 46% of community college students attained the initial goal they expressed upon enrollment. However, there are some successes worth noting:

- The number of credentials awarded by community colleges increased 127% between 1989–90 and 2009–10, while enrollment increased over 65% during that same period.
- Not only has the community college student body become more diversified, it also has seen a large decrease in the attainment gap between Whites and students of color over the past 20 years. While Whites have had a 90% increase in earned credentials and a 17% increase in enrollment, Black students have had a 283% increase in earned credentials and a 137% increase in enrollment, and Hispanic students have shown a 440% increase in earned credentials and a 226% increase in enrollment.
- The number of workforce-specific certificates of varying lengths have seen large increases over the past 20 years. Those requiring less than one year of study

increased 459% over the past 20 years, whereas those of moderate length (1–2 years) increased 121% (Mullins, 2011).

Higher Education in Iowa

Iowa higher education institutions enrolled more than 363,000 students in Fall 2011: 73,948 attended public 4-year institutions and 57,973 were students of private, non-profit 4-year institutions, whereas the largest percentages enrolled at private, for-profit institutions (n = 123,104) and at community colleges (n = 105,975; Iowa Coordinating Council on Post-High School Education, 2011).

Enrollment, based on reported fall enrollment at all sectors of Iowa colleges and universities, has increased over the past 5 years. The most significant increases have been at Iowa's community colleges, where enrollment increased 22.1% from 2005 to 2009, and at Iowa's for-profit institutions, which experienced a 164% increase in enrollment over the same time period. The majority of the enrollment increase at Iowa community colleges was from Iowa residents, who made up 93.2% of total community college enrollment in 2009 (Iowa College Student Aid Commission, 2010a).

The remaining review of the literature is devoted to the variables that affect student persistence as presented most often in the literature. These include academic and social integration; institutional characteristics and fit; goal commitment; environmental pull factors, such as work and family responsibilities; and factors related to financial aid as well as social and cultural capital including debt aversion and encouragement from family and friends.

Academic Integration

Tinto's (1975) model of student integration specifies that academic integration (i.e., interactions with faculty, time spent on homework) positively influences students'

persistence decisions. Similarly, Astin (1993) found that academic development was facilitated through high school GPA and college admissions tests as well as by time spent studying, attending classes, and engaging in academically related activities that elicit a high degree of student involvement (p. 382) including student–student interactions and student–faculty interactions. Similar factors have been shown to play an important role in Hispanic students' persistence and degree attainment (Hurtado, Carter, & Spuler, 1996; Suarez, 2003; Torres, 2006).

Nora and Cabrera (1996) found that students' cumulative GPA at the end of their first year in college was three times more important in college persistence for Hispanic and African American students than it was for their White counterparts. In a study looking at 6-year retention/graduation rates at a 4-year institution, Whalen and Shelley (2010) found that students' GPA for their last registered term was the most significant predictor of graduation. Students with a 0.10 grade point unit higher (3.10 vs. 3.00) were 91.73% more likely to graduate or be retained at year 6.

Equal in influence to students' academic performance (GPA) on transfer to 4-year colleges and bachelor-degree attainment among community college students is full-time attendance (V. E. Lee & Frank, 1990; V. E. Lee, Mackie-Lewis, & Marks, 1993). In contrast, enrolling in developmental coursework and changing majors after initially declaring one were both found to be negative influences on degree attainment (Crisp & Nora, 2010; Kerysa, 2007). In fact, an entry-level remedial level course, such as pre-algebra, was required by more than one-third (36%) of those who hoped to transfer to a 4-year program in a STEM field (Hagedorn & DuBray, 2010).

Hurtado and colleagues (2006) found that, on average, White students had taken more college preparatory classes in high school and had higher science achievement compared to minority students. Research from Crisp, Nora, and Taggert (2009) demonstrated that, once enrolled in higher education, those who enrolled in Biology I or Algebra the first semester of college were more likely to enroll in STEM majors. However, only 12.6% of students planning to transfer to a 4-year school in a STEM field could start community college at college-level math (Hagedorn & DuBray, 2010).

Social Integration

Social integration is defined as time spent outside the classroom being involved in activities that further integrate students into their academic environments. Social integration, as proposed by Tinto (1975, 1987), has long been found to be significant factor in student success in higher education. Astin (1993), for instance, found that retention was facilitated by hours spent socializing with friends, partying, talking with faculty outside of class, and being a guest in a professor's home (p. 196). However, when it comes to Latinos, much of the link between social integration and persistence has not been proven (Nora & Cabrera, 1996; Nora, Cabrera, Hagedorn, & Pascarella, 1996).

Several recent research studies (McDonough & Calderone, 2006; Linnehan, Weer, & Stonely, 2006, as cited by Dowd, 2008) tested the influence that a student's racial and ethnic characteristics have on the advice they receive from institutional agents such as counselors and advisors. McDonough and Calderone (2006) concluded that counselors who worked in schools with a majority of minority students did not have high expectations for their students. Likewise, guidance counselors in the study by Linnehan et al. (2006, as cited in Dowd, 2008) indicated that advisors would be more likely to counsel middle-class Black students with low

academic performance to attend a community college than they would White students with similar characteristics (Dowd, 2008).

Institutional Characteristics

There has been much research in the past several decades to suggest that degree aspirations and eventual degree attainment are largely determined by where individuals begin their postsecondary education. Coley (2000), for instance, found that the degree aspirations of community college students were more modest than those of their 4-year counterparts. When comparing differences between public and private institutions, Pascarella and Terenzini (1991) suggested that attending a private rather than a public college or university has a positive effect on bachelor's degree attainment and overall level of educational attainment.

Indeed, much empirical evidence supports these claims. Current data from the NCES (2011) verified that degree completion varies widely by type of institution. For example, at public 4-year institutions with open admissions policies, 29% of students completed a bachelor's degree within 6 years. At public 4-year institutions where the acceptance rate was less than 25% of applicants, the 6-year graduation rate was 82%. Two-year institutions, on average, graduated 30% of their students within 150% of the time required to complete the degree.

In addition to academic and social integration, other institutional characteristics, policies, and practices also have been shown to affect student persistence. For instance, community colleges with more than 1,000 students and/or with a smaller percentage of full-time faculty tend to have lower rates of student persistence (T. Bailey, Calcagno, Jenkins, Leinbach, & Kienzl, 2006). Crisp and Nora (2010) found that student persistence and

transfer from community college to 4-year institution was one and a half times greater for Latinos in Hispanic-serving institutions.

It has been found that the organizational culture within colleges and universities can introduce barriers ranging from blatant discrimination to subtle messages that dissuade students of color from the successful pursuit of a college degree. Nora and Cabrera (1996) found that those students perceiving discrimination on campus were less likely to be successful.

Goal Commitment

Tinto's (1975) theory asserts that the match between a student's goals and academic ability and the institution's academic and social integration helps shape two underlying commitments: commitment to an educational goal and commitment to the institution. Accordingly, the higher the commitment to the goal of college completion and/or the level of institutional commitment, the greater is the probability of persisting in college. Okun, Benin, and Brandt-Williams' (1996) study of the relationship between a student's commitment to academics as compared to other non-college activities found that relationship to be higher among students who place a high priority on doing well in college compared to students who place a moderate priority on doing well in college. Nora and Cabrera (1996) found that students' goal commitment, for both minorities and nonminorities, was most strongly influenced by parental support and encouragement and academic and intellectual development as measured by GPA. Cabrera et al.'s (1992, 1993) studies found nearly identical linkages between goal commitment and institutional commitment on a student's intention to persist with a large direct effect on goal commitment from encouragement from family and friends.

Environmental Pull Factors

External factors related to home and work responsibilities have been shown to influence student persistence, especially among at-risk and minority populations. Family responsibilities and working off campus pull students away from full social and academic integration on campus and directly influence their ability to succeed in college (Nora, 2003; Nora et al., 1996).

Parent Income

Low-income status also is related to decreased degree attainment. According to *The Condition of Education* report by U.S. Department of Education I 2011 (NCES, 2011), about 68% of 12th graders in high-poverty schools graduated with a diploma in 2008, compared with 91% of 12th-graders in low-poverty schools. Similarly, a recent study by the Annie E. Casey Foundation (2011) found that children who both live in poverty and read below grade level by third grade are three times as likely to not graduate from high school as students who have never been poor.

Braeden (2008) found that, of 46 industrialized nations, the United States ranked 42nd in teacher quality distribution, meaning the lower-income neighborhoods and communities were more likely to have teachers deemed of lower quality than those in more affluent areas. For instance, 68% of upper-income 8th graders in the U.S. study sample had math teachers deemed to be of high quality, compared to only 53% of those for low-income students.

Employment Status/Supporting Dependents

In Astin's (1993) seminal study, *What Matters in College? Four Critical Years Revisited*, he found that the biggest negative effect of working full-time was completion of a bachelor's degree. It also was negatively correlated with college GPA, graduating with

honors, and enrollment in graduate or professional school. In regard to college major choice, working full time had a weak, but significant, positive effect on pursuing a career in business and a weak, but significant, negative effect on pursuing a degree in science. Indeed, findings for those working part time off campus were nearly identical to those working full time, whereas working at a part-time job on campus was positively associated with obtaining a bachelor's degree (Astin, 1993, pp. 387–388).

Berkner, He, Mason, Wheeless, and Hunt-White (2007) found that, of those students who began their studies at 2- and 4-year institutions in 2003, 70% of those who attended college part time left without a degree within 3 years. This is in sharp contrast to those who attended college full time: 17% of those attending a 4-year institution and 40% of those attending a 2-year institution left within 3 years without getting a degree.

Miller, Danner, and Staten (2008) discovered that students who work long hours are less likely to interact with faculty and be involved in campus activities and have lower GPAs than do those who work less. Similarly, the inability to more fully concentrate on their education can extend the length of time it takes for students to graduate (Moreno, 1998). According to a 2003 analysis of federal statistics, the vast majority of students who work but don't borrow (82% of them) attend community colleges (Burdman, 2005, p. 5).

Specifically related to students of color, King (1999) posited that Hispanic students who work are far less likely to complete a bachelor's degree than are Hispanic students who borrow to pay for college. Likewise, Santiago (2007) learned that Hispanics were more likely to be independent students with dependents (31%) than were all undergraduates (27%). In a similar study, the presence of children for minorities reduced the likelihood of persisting in college by a startling 87% (Nora et al., 1996). For minorities, attending college often

means foregoing salaries that would otherwise contribute to the household (Zarate & Pachon, 2006).

Financial Impacts

Financial Aid

The effect of tuition and financial aid on persistence and in determining students' college participation decisions has been studied extensively. St. John (1990) found that grants, loans, and work–study awards have been found to have a positive effect on year-to-year persistence. However, these same factors were determined to have a negative effect on within-year persistence (Paulsen & St. John, 2002). In addition, studies of national data observed that family income was consistently associated with higher levels of persistence (Novak & McKinney, 2011; St. John, 1990). Titus (2000, as cited in Dowd 2008) posited that aid effects on second-year persistence differ by income group. He concluded that aid amounts are not sufficient to promote the retention of low-income students. However, Bowen et al. (2009) discovered a positive relationship between aid and graduation among low- and medium-income students but not among high-income students.

Other research has specifically examined the use of Pell grants and scholarship aid. DesJardins, Ahlburg, and McCall (2002) and Singell (2002) concluded that merit scholarships have a positive effect on retention; however, these are often disproportionately awarded to higher income students. Research by Novak and McKinney (2011) suggests that financial aid may have a positive effect on student completion, especially among Pell-eligible students. When comparing low-income students who filed a FAFSA, for example, with those who did not, they found that FAFSA filers have 122% higher odds of persisting than do their lower-income peers who did not file a FAFSA.

Research also has found that financial aid levels vary by race. Despite the huge need for financial aid among Hispanic students, "the disparity in average amounts received, however, has remained unchanged since 1995-1996" (*Latino Students Lag,* 2005, p. 1). Furthermore, as stated in this same study, although Latinos were more likely to receive federal aid (50%) than all groups except African Americans (62%), they received the lowest average federal awards.

Lower levels of aid also are associated with attendance at 2-year institutions and lower levels of retention and degree completion (Novak & McKinney, 2011). The same was found to be true even after controlling for academic preparation (Bound, Lovenheim, & Turner, 2009). Dowd (2004) found that loans enable social integration, which has a positive effect by enabling better academic performance.

Financial Attitudes/Concerns

Unlike other studies that employed only finance attitudes (Mallette & Cabrera, 1991; Metzner & Bean, 1987) or financial aid (Nora, 1990; Voorhees, 1985), Cabrera et al.'s (1992, 1993) studies using the integrated model of student retention not only took into account the actual awarding of financial aid (which underscores an objective assessment of the availability of resources), but also incorporated attitudes that reflect students' assessments of the extent to which financial needs are being met not only from financial aid but from other sources as well (i.e., family, jobs, friends). Thus, Cabrera et al.'s (1992, 1993) studies presented a more comprehensive perspective of student finances within the persistence process. They found that, although financial attitudes did not directly affect intention to persist or actual persistence, it did indirectly affect it through its significant direct effect on

the noncognitive aspect of academic integration. It addition, it was directly correlated to financial aid, which also directly impacted intention to persist.

Financial Aid Knowledge

Several researchers (McDonough & Calderone, 2006; Perna, 2004; St. John, 2006) asserted that a main causal factor for the low number of minority and low-income students in college is a lack of knowledge about college costs and a perceived lack of financial aid availability. In an exploratory study of the obstacles to college enrollment among Hispanic high school seniors, Immerwahr (2003) noted that many students who are academically qualified to attend college are "shockingly misinformed about higher education" (p. vi), particularly in terms of college admissions and financial aid processes.

According to a report by the Tomás Rivera Policy Institute (Zarate & Pachon, 2006), "three-fourths of young adults not currently in college would have been more likely to attend college if they were exposed to better information about financial aid" (p. 2). Further supporting this lack of knowledge, the report went on to say that more than half of all Hispanic parents and 43% of Hispanic young adults were not able to name a single source of financial aid to pay for college.

The role and influence of financial inequalities on preparation and access also need to be further considered (St. John, 2006). Perna (2004) found that most students and their parents acquire knowledge and information about college tuition and financial aid too late, often after having made decisions (particularly with regard to academic preparation) that influence their ability to attend college. O'Connor, Hammack, and Scott (2009) attributed the overrepresentation of Hispanics in community colleges to this phenomenon, stating,

"Hispanic parents having difficulty accessing information about higher education" (p. 197) adversely affected their educational planning process.

Social and Cultural Capital

As several researchers noted, college aspirations are socially constructed (Archer & Hutchings, 2000; McDonough & Calderone, 2006). Students' expectations of themselves, their senses of fit in academic environments, and their future goals are greatly influenced by the ways parents, teachers, advisors, and peers see and interact with them. This can be defined as a measure of a student's social capital. Similarly, cultural capital is related to *habitus*. Bourdieu (1986) described habitus as a "common set of subjective perceptions held by all members of the same group or class that shapes and individual's expectations, attitudes and aspirations" (p. 9). Although not deliberate, intentional, or conscious (Bourdieu, 1973), individuals make decisions by looking at others like themselves, considering what is good or appropriate, and managing their college choices accordingly. McDonough (1998) stated that, generally speaking, students with similar academic achievement and social class/racial backgrounds will make roughly the same college choices, which are different than those with similar academic abilities from different class and ethnic backgrounds (p. 184).

Cultural Capital

The term cultural capital, as defined by Bourdieu (1986), most often refers to children who gain educational, social, and intellectual knowledge from being a part of highly educated and intellectually sophisticated families. Parents value, and transmit to their offspring, education as a way to maintain class status and continued economic security (McDonough, 1998). This most often is measured by parent education levels. However, it

also is hypothesized in this research study that parents pass on beliefs to their children about their willingness or lack thereof to take on debt.

Parent education levels. Highly educated parents instill the values of education in their children at a young age. This often correlates with children who are better prepared academically to succeed. Research has shown that higher levels of parental degree attainment correlate with higher GPAs for their children (Pascarella, Wolniak, Pierson, Terenzini, & Schuh, 2003; Yazedjian, Toews, & Navarro, 2009). In a study of 41 countries, Chiu (2010) found that families with more resources (family socioeconomic status, two parents, native born, books or cultural possessions) had higher mathematic scores; likewise, first-generation students in Penrose's (2002) study had lower SAT verbal and mathematics scores.

Debt aversion. Many researchers have suggested that the growing gap in enrollment and college participation among students of color and low socioeconomic status is due, in part, to a reluctance to take on debt (Burdman, 2005; Callender & Jackson, 2005; Chen & DesJardins, 2008; Gladieux & Perna, 2005; J. Kim et al., 2009). It has been hypothesized that this attitude toward debt is a learned behavior that comes from observing parents and others within their culture. This can affect students' aspirations toward college early on and discourage them from preparing adequately for entry into college. Other evidence suggests that this may be more evident among students of color than among Whites.

Malcom and Dowd (2012), for instance, found that undergraduate debt seems to be a deterrent for many students who might otherwise pursue a graduate degree in a STEM field. Caliber Associates (2003, as cited in Dowd, 2008) showed that patterns of risk aversion and willingness to borrow are evidenced in other forms of borrowing as well as for education.

They noted that having a home mortgage is a strong positive predictor of college enrollment and borrowing for college. In fact, they pointed out that White students native to the United States are about 1.5 times more likely than native Hispanics and Blacks to hold a mortgage or own their home outright.

Volkwein, Szelest, Cabrera, and Napierski-Prancl (1998) found that Whites have much lower default rates than do underrepresented minorities. These findings were not significant, however, once controls were added to the model for earned degrees, marital status, and family size. Among the racial and ethnic groups studied, the key predictors of loan default are identical—failure to complete a degree; having dependent children; and being single, widowed, or divorced—but the magnitude of effects are much larger among minority students. This signifies that low-income minorities have been disproportionately affected by the increasing importance of loans in the financial aid system, as demonstrated by their lower rates of degree completion (Gladieux & Perna, 2005), substantially higher loan default rates (Volkwein et al., 1998), and greater debt burden (Price, 2004). The findings are significant because they indicate that differences in attitudes toward debt and actual borrowing behaviors are interrelated to various socioeconomic influences, such as parental education, family income, and ethnicity (Dowd, 2008).

Although most studies to date have measured debt aversion by observing actual loan debt, Davies and Lea (1995) developed a scale to measure debt attitudes. They reported that higher levels of college student debt were related to higher debt tolerance attitudes, but also that debt tolerance appeared to increase after students became indebted.

Social Capital

The way that parents, teachers, advisors, and peers see and interact with students influences students' expectations of themselves, their senses of fit in academic environments, and their future goals (Bourdieu, 1973). Bourdieu (1986) also described social capital as the resources that are gained through membership in a group and the "size of the network of connections that he can effectively mobilize" (p. 249). Typically this has been measured by encouragement and direct involvement from parents, family members, peers, and institutional agents. Most recently, data also have begun to show that parents' attitudes toward debt as well as their beliefs about paying for higher education can also negatively affect their child's degree aspirations and eventual persistence.

Access to information and institutional agents. The role of families and parent–child relationships are critical to student access to higher education (D. H. Kim & Schneider, 2005). The authors stated that social capital is "the influencing factor for educational outcomes of children independent of socioeconomic characteristics" (p. 1182). They emphasized the role of parents in contacting appropriate institutional agents about the college application process and suggested that is an important role in enhancing children's opportunities to attend a selective college (p. 1185).

Likewise, O'Connor et al. (2009) suggested that minority students do not have access to the social networks that may serve as pathways for college opportunities. In fact, it was advocated that social capital can act as a deterrent to college access if appropriate access to information is not given to students. Stanton-Salazar (1997) argued that such institutional agents as teachers, counselors, and middle-class peers provide access to resources and opportunities, including information about college and help with college admissions

requirements, but that institutional structures limit the ability of working-class minority students to develop "trusting" relationships with institutional agents. Among these deterrents are the focus of schools on bureaucratic processes, the dual role of faculty and advisors as mentors and gatekeepers, and the short-term duration of interactions.

Encouragement from others. Perna (2000) found that parental encouragement as measured both by a mother's educational expectations for the student and parental involvement, and encouragement of school personnel increase the likelihood of college enrollment for Whites but are unrelated to the level of college enrollment for African Americans and Hispanics. Peer encouragement in Perna's (2000) study was found to be unrelated to college enrollment for all three groups.

In a study of first-generation ethnic minorities, Dennis, Phinney, and Chuateco (2005) demonstrated that a lack of needed support from peers was an important predictor of college GPA, even when the strong effects of academic aptitude as indicated by high school GPA were controlled. They argued that peers can provide support that parents of first-generation college students cannot. This includes forming study groups, sharing notes and experiences, and giving advice about classes to take and strategies to use.

Similarly, in a study by Hurtado et al. (1996), Latino college students reported that college peers provided the most support in their first year. They also found that peer support was more closely related to social adjustment, whereas parental support was a better predictor of emotional adjustment.

Okun et al. (1996) demonstrated the dramatic impact of the interaction between encouragement from others and intentions to transfer. For those who intend to stay, encouragement to stay has virtually no effect on the probability of enrollment. However,

among those who intend to transfer, there is a powerful impact of encouragement to stay on actual departure. As encouragement to stay decreases, students intending to transfer are much more likely to depart.

Parent education levels. Although parent education often is used as a measure of cultural capital, it also can influence social capital. Parents with higher education levels are more likely to have the experience and resources to help their children achieve a college degree (Spera, Wentzel, & Matto, 2009). Similarly, Furstenberg Cook, Eccles, Elder, and Sameroff (1999) observed that, although parents generally believed that their children needed a college degree to be successful, many of the low-income parents in their study lacked "adequate knowledge of the middle-class world to guide their children in how to succeed" (p. 226).

Conceptual Framework for Study

Integrated Model of Student Retention

The integrated model of student retention combines the work of Tinto (1975, 1987) and Bean (1982) into one working model that further considers the integrated role of financial factors in the persistence process. According to Cabrera and colleagues (1992, 1993), the adaptation of these models into a causal model allows the researcher to explore the interrelations among and within these variables and to more adequately test the appropriateness of the model against differing student populations.

Tinto's (1975) student integration model has been subjected to considerable testing, and research findings have largely supported the predictive validity of the model as far as the role of precollege variables is concerned. Results are mixed, however, when the structural relations that the theory presumes to exist among academic integration, social integration,

and institutional and goal commitments are subjected to empirical testing (Cabrera et al., 1993). The model is also not as useful when determining the role of finances. Tinto's (1975) model discusses the importance of finances on shaping educational goals and on selection of institution but assumes no effect on subsequent persistence behaviors (Cabrera et al., 1992).

Bean's (1982) student attrition model is similar to Tinto's (1975) model but differs most prominently by its inclusion of factors outside the college environment, such as work and finances and the role of family and friends, as explanatory variables. In this model, finances comprise two dimensions: an objective dimension, reflecting a student's availability of resources, and a subjective dimension, reflecting a student's perception of his/her difficulty to finance college-related expenses (Cabrera et al., 1993). The role of family approval in institution choice and parents' and friends' encouragement to continue enrollment also is emphasized.

In studies using both the student integration model (Tinto, 1975) and student attrition model (Bean, 1982) as a theoretical framework, the implicit role of finances has been found to impact students' persistence not only directly but also indirectly through other variables. Using Tinto's (1975) model, Cabrera et al. (1992) found that financial factors can affect a student's academic and social integration process as well as his/her commitment to degree attainment and to the institution. Likewise, Bean and Metzner (1985) found that a composite of financial attitudes and family income had a significant impact on persistence and a smaller, yet significant, effect in institutional fit; and also that financial attitudes had an impact on persistence (Metzner & Bean, 1987) and an impact on institutional fit (Bean & Vesper, 1990, as cited in Cabrera et al., 1992).

In an attempt to combine the two models and also address their limitations, Cabrera and associates (1992, 1993) tested a new integrated model of student retention to better explain student persistence. In their 1992 study, they found that financial attitudes and actual financial aid received had differing effects on several of the variables and should not be collapsed into one construct as previous studies had done. They also used actual student aid awarded rather than socioeconomic status, arguing that it incorporated other dimensions than just ability to pay, including parental educational attainment, parental involvement, and occupational status.

Student/Institution Engagement Model

Expanding on Nora and Cabrera's (1996) work, Nora (2003) proposed the student/institution engagement model, which emphasized the unique interaction between the student and the institution, examining precollege, college, and environmental pull factors related to minority and other at-risk populations pursuing a baccalaureate degree. The present study focused specifically in Nora's (2003) conceptualization of environmental pull factors, or the characteristics that can pull a student away from engagement on campus. These factors include family responsibilities, work responsibilities, and whether and how far the student commutes to college.

Bourdieu's Social Capital Theory

Social capital, as defined by Bourdieu (1973), offers a framework for understanding how individuals and organizations interact and relate to one another. He defined habitus as an internalized, permanent system of outlooks and beliefs about the world that an individual learns from his or her immediate environment. It is a common set of subjective perceptions,

held by all members of the same group or class, which shapes the individual's expectations, attitudes, and aspirations (McDonough, 1994).

Social capital allows students to have access to important human, cultural, and other forms of capital, such as institutional resources and support, which provide them the necessary tools to be successful. Social capital is acquired through social networks with family; friends; and institutional agents such as teachers, counselors, and peers (McDonough, 1994).

Although Bean's (1982) student attrition model and Cabrera and colleagues' (1992, 1993) model focus on encouragement from family and friends as an environmental variable and peer relationships at the institution as a social integration variable that influences eventual persistence, they do not consider the active involvement of parents and significant others such as counselors and other staff. They also do not consider parents' socioeconomic status as a measurement of social capital.

The reluctance to take on debt is an additional variable within the social capital construct that was examined in the present study. Many researchers have suggested that the growing gap in enrollment and college participation among students of color and low socioeconomic status is due, in part, to a reluctance to take on debt. (Burdman, 2005; Callender & Jackson, 2005; Chen & DesJardins, 2008; Gladieux & Perna, 2005; J. Kim et al., 2009; Trent et al., 2006). Specifically for Latinos, undergraduate debt seems to be a deterrent for many students who might otherwise pursue a graduate degree in a STEM field (Malcom & Dowd, 2012). The present study examined the effect of indebtedness on the intention to transfer among community college STEM students.

System Retention Framework

Based on transcript analysis of transfer student retention, Hagedorn and colleagues (Hagedorn & Cepeda, 2004; Hagedorn et al., 2006, 2008) affirmed that a community college student's academic success increases the likelihood of transfer to a 4-year institution and has a positive influence on student retention in postsecondary education. As such, the present study conceptualized a student's intent to transfer from a community college to a 4-year institution as student persistence in postsecondary education. This is similar to how Reason (2009) and Starobin et al. (2012) applied a systems approach to conceptualize student mobility in their studies as well.

Summary

This chapter provided a thorough review of the literature related to student persistence and success in higher education, particularly as they relate to community college students. It included a discussion of key variables of interest in this study including academic and social integration, academic performance, institutional fit, goal commitment, environmental pull factors, social and cultural capital, and debt aversion as well as provided information about the conceptual framework that guided this study. The next chapter presents a complete discussion of the methodological orientation of the study including sampling procedures, instrumentation, and statistical analyses.

CHAPTER 3. METHODOLOGY

Introduction

The purpose of this study was to (a) refine Cabrera et al.'s (1992, 1993) integrated model of student retention using the addition of recent research on social and cultural capital and on debt aversion and (b) add to the body of research that has examined the changing demographics and needs of community college students, particularly to study the transfer intentions of disadvantaged, rural Iowa students in STEM fields.

The results of the study have the potential to have a significant effect on the research related to student success of community college students and their intent to transfer to a 4-year university, particularly as it relates to increasing the number of STEM students transferring from community colleges to 4-year institutions.

Research Questions

The objective of this study was to address the following research questions:

1. What are the background and demographic characteristics of the students who participated in the SSSL study?
2. Are there statistically significant differences between demographic variables, such as age, gender, enrollment status, ethnicity, and number of math and science courses taken, between the students who do not intend to transfer and those students who do intend to transfer into a STEM field?
3. Are there statistically significant differences between financial variables, such as number of hours worked, number of dependents supported and amount of financial aid received, between the students who do not intend to transfer and those students who do intend to transfer into a STEM field?

4. How do factors related to social/cultural capital (i.e., debt aversion, parental involvement, parent education levels, family encouragement, and access to institutional agents) influence community college students' intention to transfer to a 4-year institution in a STEM field after graduation?
5. How do factors related to students' ability to finance their education as well as environmental pull factors and financial concerns related to enrollment and employment status and support of dependents influence community college students' transfer to a 4-year institution in a STEM field?

Hypotheses

The inferential research questions addressed in this study are organized into two areas. The first area relates to the presumed effects of social and cultural capital and debt aversion on transfer intentions. The second area examines the presumed effects of financial concerns, environmental pull factors, and the influence of types of financial aid on students' intentions to transfer in a STEM field.

Although Cabrera et al.'s (1992, 1993) model does not explain the role of social and cultural capital on intentions to transfer, their model does suggest certain associations. Their model of student retention assessed the significant positive impact encouragement from family and friends had in securing a college degree, which is a portion of the social and cultural capital construct. Additionally recent research has suggested that debt aversion may be another deterrent to intent to transfer.

H1: The role of parent involvement in high school has a significant effect on transfer intentions.

H2: The more encouragement and direct involvement from family and friends, the higher the probability of a student's transfer intentions.

H3: Access to institutional agents to help with the transfer and advising process add to a student's social capital, and therefore, increases the probability of transfer intentions.

H4: The higher the aversion to debt, the lower the probability of a student's transfer intentions.

Regarding the financial factors related to how a student pays for college, along with any stressors related to employment or family obligations:

H5: Consistent with Nora's (2003) student/institution engagement model, it is hypothesized that environmental pull factors, including employment and number of dependents supported, will have a negative effect on intention to transfer.

H6: Consistent with the integrated model of student retention (Cabrera et al., 1992, 1993), it is hypothesized that concern for finances will have a negative effect on intentions to transfer.

H7: Consistent with the integrated model of student retention (Cabrera et al., 1992, 1993) and other related research (Bowen et al., 2009; Dowd, 2004; Novak & McKinney, 2011; St. John, 1990), it is hypothesized that loans, scholarships, and grant aid, along with work–study on campus, will have a positive effect on intentions to transfer.

Research Design

This study is part of a larger, multiyear project being led by Dr. Soko Starobin, Iowa State University Assistant Professor and Director of the Office of Community College

Research and Practice, and a team of researchers interested in studying various aspects of community college students in STEM, including academic and social engagement, social capital and financial literacy, self-efficacy and transfer readiness. This project began Fall 2011 with the development of a survey instrument that would measure the specific variables of interest. Through this process, the team reviewed and analyzed other well-known and respected instruments used to study student engagement and success in the past including the Community College Survey on Student Engagement, the National Survey of Student Engagement, the Lanaan Transfer Student Questionnaire, the Transfer and Retention of Urban Community College Students survey, the Survey of Undergraduate Research Experiences, Cooperative Institutional Research Program surveys, and others. The team also consulted the Integrated Postsecondary Education Data System, and the U.S. Census to assist in establishing appropriate survey response items that are widely used in higher education and national reporting.

The final instrument used in the Spring 2012 pilot project was a compilation of items from these surveys. All rights to use these questions, in full or in part, were obtained from the various sources. Upon finalization of the instrument, permission for the pilot study was sought and granted by the Iowa State University Institutional Review Board (IRB) on March 23, 2012.

Pilot Study

Five community colleges in the state of Iowa were selected as testing sites for the survey instrument. It was administered during three weeks, mid-April through early May 2012. This provided the research team an opportunity to formally test the survey instrument and review potential issues/challenges as they related to the administration of the survey as

well as its validity and reliability. In total, the pilot study was administered electronically to 5,448 students who were enrolled in a STEM-related course in the Fall 2011 or Spring 2012 semester. A total of 565 students completed it, for a 10.4% response rate.

Following the collection of the survey responses and the subsequent analysis, it was apparent several issues and problems existed with the survey instrument, delivery of the survey, and length of the instrument. Overall student response rates were extremely low, the length of the survey led to students "dropping out" prior to answering all the questions, and issues with specific question formats, which required recoding, were identified during analysis.

Instrumentation

Prior to the implementation of this study, the results from the pilot project were analyzed to test the validity and reliability of the survey instrument as well as to assess the appropriateness and validity of individual questions. In order to determine whether the tool was useful in drawing meaningful inferences from the data, CFA was run on various constructs measuring self-efficacy, social capital, and social and academic integration among others. Among the questions asked were: Do the individual items of the construct predict the criterion measure? Do the results of individual items correlate with the results of similar items?

In the case of self-efficacy, for example, 30 items were tested. By conducting CFA, several of these items proved to measure very similar things, and 13 of the original questions were able to be eliminated, allowing the survey's length to be shortened and still get a good measure of the construct. Likewise, if there was an outlier (typically with a factor loading below .6), it was removed from the construct. To further test the constructs, the responses

were randomly divided into two subsets to ensure consistency and reliability among the variables. Very high Cronbach's alpha scores suggested the quality of the constructs and indicated that the total number of items could be reduced without jeopardizing the results.

The final survey design contains four sections related to (a) self-efficacy, (b) social capital/financial literacy, (c) transfer knowledge, and (d) demographics. Following is a description of each section. To review the entire survey, see Appendix A.

Self-efficacy. The first section of the survey consists of statements related to students' academic efficacy and goal commitment such as "If I can't do a job the first time, I keep trying until I can," "I often make a list of things to do," and "If something looks too complicated, I will not even bother to try it." It also relates to their ability to make new friends and their desire to fit in. Finally, it includes questions about the students' ability to adapt to and deal with anxiety over their most challenging course. This includes questions about time spent studying; other initiatives taken to improve performance; and receiving encouragement and helpful advice from family members, friends, classmates, and faculty and staff. The instrument consists predominantly of questions with Likert-type scale responses ranging from *strongly disagree* to *agree* (and not applicable) or *never, rarely, sometimes, often,* and *always*. Anxiety is measured on a scale of 1–10, and number of hours spent studying in the most challenging class is categorized.

Social capital/financial literacy. Second, the survey deals with issues surrounding parental income, occupations, and education levels; financial aid (grants, scholarships, loans), concerns over finances, working at a job for pay (on and off campus), and number of dependents financially supporting; and involvement of parents, family, and friends during high school. The latter questions include such questions as: during high school, how often

did your parents or other adults "work with you on your homework," "participate in school related activities," and "spend time just talking to you." Responses to these questions also are placed on a Likert-type scale ranging from *never or very rarely* to *several times a week.*

Transfer knowledge. This section consists of questions about students' academic and social integration on campus, including number of hours spent on campus outside of attending classes, number of developmental courses taken, and their use of academic supports and social interactions outside of class. It also measures institutional fit by asking questions such as: "Instructor or students made prejudiced comments that made me feel uncomfortable" and a question about whether or not they felt that faculty, staff, or administration treated them poorly due to gender, race, language, sexual orientation, religion, social class, or another reason that they could specify. In addition, questions are included about information received and perceptions regarding the transfer process to a 4-year institution. These include: "I visited the 4-year institution at least once to learn where offices and departments were located," "I spoke to former community college transfer students to gain insights about their transfer experiences," as well as asking "how often [they] discussed career plans and ambitions with a faculty member." The final questions of this section ask about their intentions to transfer and if they are planning to major in a STEM field. If yes, they are asked what program of study they are planning to major in upon transfer. Other than the categorical questions, Likert-scale responses once again are used for a majority of the questions.

Demographics. This section includes basic demographic questions including those regarding gender, race, age, marital status, religion, citizenship status, country born (if outside of the United States), and native language. It also includes questions about

enrollment status, the number and type of previous math and science courses taken, and previous academic credentials earned.

Population and Sample

The study population was made up of currently enrolled students from all of Iowa's 15 community colleges who had been previously enrolled for at least one semester. Colleges were asked to exclude remedial, dual credit, and noncredit coursework when determining previous enrollment. Students under 18 were also removed from the population sample. See Appendix B for criteria used in developing the master student data file.

The *Annual Condition of Iowa's Community Colleges 2011* (Iowa Department of Education, 2011b) report provides an overview of the Iowa community college student during the 2011–12 academic year. When the academic year began in Fall 2011, 105,975 students had enrolled in the 15 Iowa community college districts. Of the nearly 106,000 students enrolled in Iowa community colleges in Fall 2011, more than half (51.8%) were enrolled part time. Students enrolled in Iowa's community colleges were in one of three academic tracks. The majority of students (64.1%) enrolled in associate of arts or associate of sciences programs, also known as college parallel programs which prepare students to transfer to a 4-year college or university. The next largest cohort of community college students (30.7%) enrolled in career and technical education programs, which prepare students to directly enter the workforce upon completion of a degree, certificate, or diploma. Iowa community college students (4.9%) also enrolled in career options programs that provide them the opportunity to transfer to a 4-year institution or pursue a career in their chosen field upon completion of the program (Iowa Department of Education, 2011a).

Students attending Iowa community colleges have a unique demographic makeup that is not generalizable to community colleges nationwide but compares favorably to rural midwestern community colleges of similar sizes. During the 2011–12 academic year, the majority of Iowa community college students were female (55%) and between the ages of 19 and 25 (72%). The average age for Iowa community college students was 23 years. An overwhelming majority (92%) of students attending Iowa community colleges were residents of the state of Iowa. Of the Iowa community college students who reported their ethnicity during the 2011-12 academic year, 86% of students were Caucasian, 7% were African American, 5% were Hispanic, 2% were Asian/Pacific Islander, and 1% were of two or more races (Iowa Department of Education, 2011a).

In total, 43,964 Iowa community college students (over 40% of total enrollment) were invited to participate in the study. More than 6,000 students responded to at least some of the survey questions. After removing the students who logged into the study but did not complete the study, the final sample size was 5,140 students for a total response rate of 11.7%. Individual community college response rates were as follows: Northeast Iowa Community College (CC), 20%; North Iowa Area CC, 13.4%; Iowa Lakes CC, 11.7%; Northwest Iowa CC, 32.8%; Iowa Central CC, 11.5%; Marshalltown CC, 8.6%; Ellsworth CC,7.1%; Hawkeye CC, 43.5%; Eastern Iowa CC District, 12.4%; Kirkwood CC, 10.5%; Des Moines Area CC, 14.4%; Western Iowa Tech CC, 21.5%; Iowa Western CC, 17.8%; Southwestern CC, 7.8%; Indian Hills CC, 9%; and Southeastern CC, 9.6%.

Data Collection

Permission was received from each study institution to distribute the SSSL survey via e-mails to students enrolled in certain courses. The specific courses chosen for participation

was done with the help of the principal contact at each college, based on the interest and availability of each instructor and the ease of collection. Care was taken to identify courses that were not likely to have first-semester students in them. This convenience sampling design was used to ensure high-quality response and participation rates.

The decision on which collection method to use was based on the needs of the institution, the desire of the faculty member administering the survey, and the demographics of the students involved. Whenever possible, class time was given to get the maximum response rate. Electronic surveys were e-mailed to the students whenever class time could not be allocated. In these instances, it was requested that faculty make announcements of the survey in class to encourage participation.

Students were notified that they were part of a select group of students identified to help in a research study to ascertain the level of transfer readiness of community college students in STEM fields. They were given instructions on how to complete the survey in Qualtrics. They also were informed of the fact that all data would be stored in a password-protected computer with the password known only to the researcher as well as that all individual information would be confidential and results presented in a manner that would not allow the identification of individuals. In addition to in-class administration of the survey, instructors and/or administrators were asked to send out introductory and reminder e-mails as needed and post on their college's intranet as appropriate. To encourage high participation, a drawing was also held to win an iPad. According to Porter (2004), multiple contacts about a survey, perception of scarce opportunity to be involved, and requests for help have been found to increase survey response rates.

The following timeline was utilized for survey distribution:

October–November:	Introductory e-mail with instructions and link to web-based survey, begin administration of survey in classes
One week later:	Reminder e-mail #1
Two weeks later:	Reminder e-mail #2
Three weeks later:	Survey closed
December	Data clean up/initial analysis and recoding

Conceptual Model

In studying the role of finances in the persistence process, Cabrera et al.'s (1992, 1993) model measures the impact of institutional commitment, goal commitment, academic integration, social integration, academic performance, significant others' influence, and a composite of financial attitudes and financial aid received on the dependent variables of intention to persist and eventual persistence. The present study tested the Cabrera et al. (1992) model with some adjustments based on recent literature and empirical evidence (see Figure 3.1).

A statistical technique known as SEM was used in this study. This technique allows for (a) simultaneous estimation of the measurement and structural models, (b) examination of direct, indirect, and total effects among the constructs,(c) assessment of the "goodness of fit" of the conceptual model, and (d) reporting of the total variance explained by the model overall (Byrne, 2010). The hypothetical SEM model shown in Figure 3.1 represents relationships among observed and unobserved variables using path diagrams. Ovals or

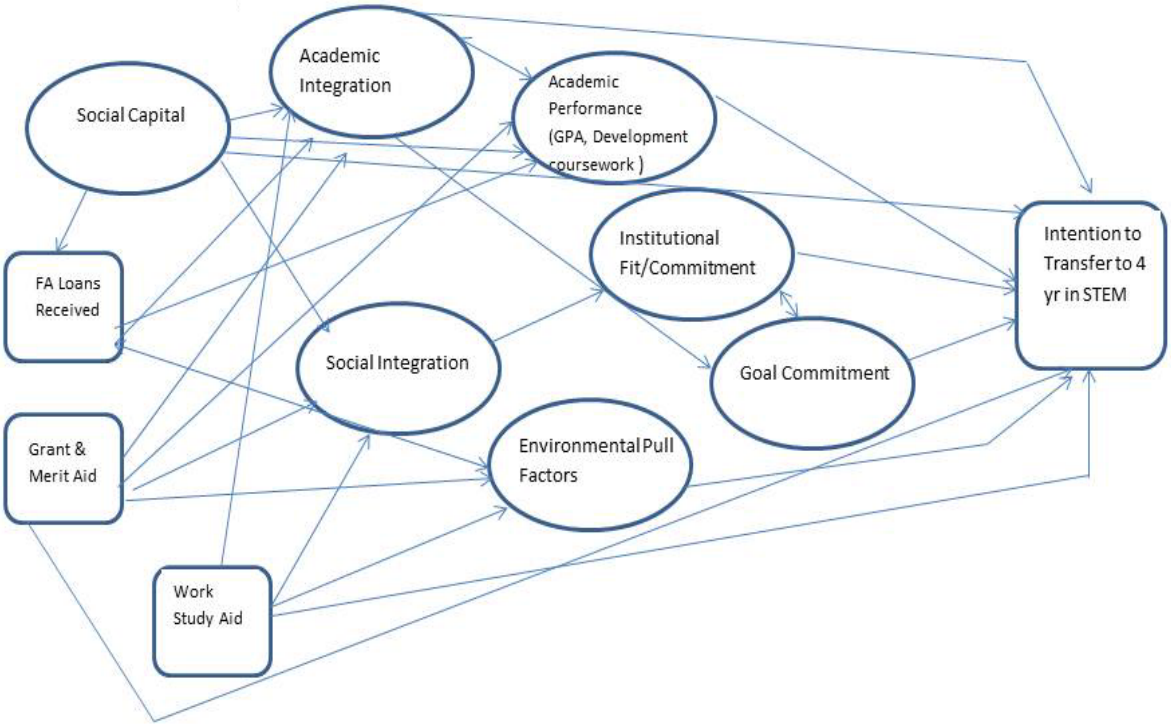

Figure 3.1. Kruse hypothetical model based on Cabrera et al.'s (1992) integrated model of student retention and variables related to social capital (Bourdieu, 1973, 1986), finances, and debt aversion.

circles represent latent variables, and rectangles or squares represent measured variables.

In the model, the arrows between various constructs and variables being tested represent paths to measure the direct and indirect effects among the predictors of intent to transfer. Specifically for this study, in terms of social/cultural capital and financial literacy, it measures the direct and indirect effects of cultural values, information barriers, and economic circumstances on a student's ability to borrow funds to pay for college, which have "yet to be disentangled" (Dowd, 2008). According to Okun et al. (1996), researchers have largely ignored the issue of moderators of the intention–persistence behavior relationship because the emphasis has been on testing causal models of college student departure that

emanate from conceptual frameworks that do not specify such interaction effects. Furthermore, because researchers have tended to use techniques such as path analysis to test their hypotheses, they have paid little attention to examining the linearity of the relationships between predictors and institutional persistence. Building on Cabrera et al.'s (1992, 1993) model, the hypothetical model tested both the direct and indirect effects of various predictors of transfer intentions.

Variables in the Study

This study sought to analyze variables related to financial literacy and social and cultural capital within previous models of student departure, identifying causal models rather than linear models to describe both the explicit relationship on intent to transfer and the implicit relationships among the variables. For more information on the variables in the study and how they were coded, see Appendix C.

Endogenous Dependent Variable

Intent to transfer to a 4-year university in a STEM field. The dependent variable in this study was the intention to transfer to a 4-year institution in a STEM field. Although most previous studies have used actual persistence or transfer, this study was not a longitudinal study and used intent to transfer as a proxy measure. The results were compared to look at the differences among those who intended to transfer in STEM fields, those who intended to transfer in fields outside of STEM, and those who did not intend to transfer at all.

Exogenous Variables

Finances. As mentioned previously, Cabrera et al.'s (1992, 1993) model studied an objective measure (financial aid received) and a subjective measure (satisfaction with financial aid received including grants, loans, family, and job) of finances in one construct.

Previous research has shown mixed results regarding the financial measures. According to Dowd and Coury (2006), quantitative analyses that have attempted to isolate effects of financial aid on persistence using nationally representative datasets have produced mixed findings, partly due to differences in statistical techniques, sample, and the timeframe under study. Cabrera's team themselves found that financial attitudes and financial aid received have differing effects on the various independent variables and constructs.

Given the model's testing for influence among the variables and the past research, it was believed that the measures might affect constructs differently if separated. This was further tested with exploratory factor analysis (EFA). Questions 20_4 and 20_5 relate to the amount of students loans and grants received, and Question 23 asks about having a work–study position. Regarding the subjective measure of financial attitudes and concerns, several items of Question 32 relate to having a lack of money and insufficient financial aid, and Question 21 asks about students' level of concern in financing their college education.

Environmental pull factors. The environmental pull factors associated with Nora's (2003) student/institution engagement model suggest that a set of environmental factors pull students in or "draw" them away from academic and social campus environments (Crisp & Nora, 2010). In this study's survey, Question 24 asks about how many hours were spent on a job for pay, Question 22 about the number of people currently being supported, and Question 32 about students' inability to balance work, home, and school, all of which will be used for this construct.

Social and cultural capital. Although Cabrera et al.'s (1992, 1993) model emphasizes the importance of Tinto's (1975) suggested role of social integration, it has been criticized for not being relevant to minority students (Rendon et al., 2001; Tierney, 1992). In

addition, although parent education was removed from Cabrera et al.'s (1992, 1993) model to illustrate the effects of financial need (amount of financial aid received was seen as a better proxy of financial need), it was seen as a good indicator of social and cultural capital (Bourdieu, 1973).

Research has shown that first-generation students do not have the social capital needed to navigate the college environment (Berger, 2000) and that higher levels of parental degree attainment correlate with higher GPAs for their children along with higher degree aspirations (Pascarella et al., 2003; Yazedjian et al., 2009). As such, parent education can be seen as a measure of both social and cultural capital and these measures are often difficult to disentangle (Wells, 2008). For purposes of this study, as done by others previously (Croninger & Lee, 2001; Perna, 2000; Wells, 2008), the variables used for social and cultural capital were not assigned to one type of capital or the other and the two terms were used interchangeably. This included the variables of parent education, family encouragement, parental involvement, access to institutional agents/information, and debt aversion as noted below.

Parent education. Survey Questions 17_1 and 17_2 asked students to respond by providing the highest degree earned by each of their parents. This variable was used to test the effects of social and cultural capital on intent to transfer to a 4-year institution in a STEM field. Although parent education has been used in previous models as a proxy measure for socioeconomic status, parent income information was collected in this survey for that purpose.

Family encouragement. The construct Cabrera and associates used in the 1993 study was based to a good degree on Nora's (1990) previous work, which assessed the significant

impact encouragement from family and friends had in securing a college degree. This measure was tested using Question 15 from the SSSL survey, which asked about receiving encouragement or helpful advice from a family member or friend for the student's most challenging class.

Parental involvement in high school. Although Cabrera et al.'s (1992, 1993) model is silent on the involvement of parents in student retention and success, previous research has indicated that parent involvement (in addition to encouragement) can be an important measure (Perna, 2000). Questions 23 and 24 of the present study's survey measured this variable of parent involvement during high school.

Access to institutional agents and information. As noted previously, social capital emphasizes the role of parents in contacting appropriate institutional agents about the college application process (D. H. Kim & Schneider, 2005), the role of family and friends in gaining access to the appropriate social networks that may serve as pathways for college opportunities (O'Connor et al., 2009), and having the ability to develop a "trusting relationship" with faculty and staff (Stanton-Salazar, 1997). This was measured by Questions 38 and 39 in the survey, which ask students about their use of academic advising/counseling services at the community college and their access to information regarding the transfer process.

Debt aversion. Some researchers have suggested that the growing gap in enrollment and college participation among students of color and low socioeconomic status is due, in part, to a reluctance to take on debt (Burdman, 2005; Chen & Des Jardins, 2008; Gladieux & Perna, 2005; Callender & Jackson, 2005; J. Kim et al., 2009; Trent et al., 2006). Given the rising importance of student loans in funding college education, perceptions about debt

influence the ability of loan programs to achieve their goal of equalizing opportunities for students of all incomes (Burdman, 2005). In this study's survey, Question 32_3 asked how likely "Debt—need to work more hours to pay bills" would prevent students from obtaining their college degree and Question 26_1 asked students how thrifty they were in comparison to their parents.

Number of math and science courses taken. Many studies exploring college persistence and success have used high school and/or college GPA as a measure of a student's academic ability or intellectual ability. In this particular study, however, GPA was not collected from students and researchers were not allowed to collect these data from colleges due to IRB restrictions. In terms of looking at the intentions to transfer to a 4-year institution in a STEM field, however, several researchers have found it most appropriate to measure the number of math or science courses taken previously in determining potential for success among STEM students (Crisp et al., 2009; Hagedorn & DuBray, 2010; Hurtado et al., 2006).

Data Analysis

This study employed a quantitative research methodology, and the data were analyzed using IBM SPSS 20.0 and Amos 20.0 software. Descriptive, comparative, and inferential statistics were used to answer the study's main research questions.

Descriptive and Comparative Statistics

The first research question sought the identification of the background and demographic characteristics of the students who participated in the study. Descriptive statistics, including frequencies and cross-tabulations, were utilized to describe demographic characteristics such as age, gender, race/ethnicity, enrollment status, and parental education.

Financial factors analyzed included the number of hours worked, number of dependents supported, and amount of financial aid received. The second question related to the significance between the chosen independent variables and the dependent variable, intent to transfer, was analyzed using a Pearson correlation chi-square test and a discriminant analysis.

Correlation Statistics

Next, a Pearson correlation test was run utilizing the whole data set to determine whether there were any statistically significant relationships among the financial and social/cultural capital factors that influence intent to transfer to a 4-year college or university in a STEM field.

Exploratory/Confirmatory Factor Analysis

Following examination of the correlation matrix, an EFA was used to verify the validity and structure of the composite variables. The meaningful factors that emerged allowed for the inclusion of composite variables in the CFA and the measurement model, which were used to answer the remaining research questions.

A CFA then helped to examine the degree to which the covariance among the tested items was explained by the hypothesized factor structure. The decision to use CFA was based on the identification of theoretical relationships between the observed and latent variables associated with student departure and the desire to test the ability of the hypothesized model to fit the observed data. Using SPSS 20.0 and Amos 20.0, CFA was utilized to determine if the hypothesized set of constructs influenced responses in a predicted way.

Inferential Statistics

Finally, a SEM regression was utilized to measure the impacts of the identified constructs of the hypothetical models on the intentions to transfer to a 4-year institution in a STEM field. This technique was used to examine the "the nature and strength of the relations between variables, the relative predictive power of several independent variables on a dependent variable, and the unique contribution of one or more independent variables when controlling for one or more covariates" (Urdan, 2010, p. 145).

Ethical Considerations

Studies of this type must be conducted in compliance with Institutional Review Board policies (Creswell, 2009). An application to conduct research involving human participants was approved by the Iowa State University Institutional Review Board on March 23, 2012 (Appendix D). The protocol and IRB approval was forwarded to each of the study institutions in order to determine if Iowa State University's approval was sufficient and whether or not it was necessary to repeat the review at the participating institution.

Limitations and Delimitations

This particular study used a student's intent to transfer into a STEM field at a 4-year university as a proxy measure for a student's actual transfer to 4-year institution in a STEM field guided by a framework from Hagedorn and colleagues (Hagedorn & Cepeda, 2004; Hagedorn et al., 2006, 2008). If this had been a longitudinal study, actual transfer rates from the institution at a later time would have generated better results. Likewise, given the lack of longitudinal data, it was difficult to make interpretations on causality. Studying intentions to transfer at one point in time do not account for changes over time. Research that tracks aspirations and how they change and translate into actual degree attainment could be

beneficial for better understanding the structures and supports that are needed to help students succeed.

Some limitations were also inherent in the design of this study. Data were gathered from students in Iowa. Although the ethnicity breakdown was fairly representative of the community college population as a whole in the state, survey respondents were predominately White and the ratio of female to male participants was 3:1. Demographic characteristics of nonrespondents were not available, so possible nonresponse bias was not addressed.

The survey instrument used in this study presented a couple of restrictions. It was not possible for the survey instrument to include all variables of interest. Although it was intended to collect some demographic information as well as credit hour and GPA information from the institutions, that was not possible due to IRB constraints. In addition, students self-reported a great deal of information collected in the survey. Number of math and science courses taken, parent education, parent income, and financial aid received were all self-reported. In fact, the missing data due to nonresponse about parent income was so large that the data that were collected could not be used. In addition, students could choose not to answer some questions, or responses could reflect individual biases or inaccurate personal reflections. The survey was delimited to those students who had completed at least one semester of college credit as it was assumed that those students with less than one semester of credit would not be able to respond to questions related to social and academic integration adequately. For the same reason, an attempt was made to exclude students who took all of their classes online.

Summary

The purpose of this study was to examine community college students in Iowa in order to determine differences in background and demographic characteristics between those students who intended to transfer into STEM fields and those who did not. This chapter summarized the study's research questions, population, instrumentation, data collection, variables and constructs examined, and methods of data analysis. The study employed a quantitative research design using a survey designed from several nationally known and validated survey instruments.

The next two chapters will present the results of the study outlined in this methodology section and discuss the significance of the findings and their implications for future research, policy, and practice. The information gleaned from this work was intended to increase the knowledge base about the persistence of Iowa community college students into STEM fields at 4-year institutions and add to the literature about the factors that affect community college student retention.

CHAPTER 4. RESULTS

This chapter provides a comprehensive overview of the results of this study and is organized into three sections. The first section provides an analysis of the descriptive statistics of the population in this study. The second section describes the tenets and assumptions that are required to work with SEM. The final section includes an analysis of the results for each research question.

Descriptive Statistics

With regard to gender, females made up more than 72% of the study sample, and more than half of them were over the age of 24. The age distribution of all students in the study sample ranged from 18–65 years, and the average age was 29 years.

Slightly more than a quarter (27.8%) of all respondents were married, and the largest group was single, never married (46.4%). Over half (50.4%) of all respondents reported supporting at least one dependent, and the remaining (49.6%) had no dependents.

About 19% of the participants were unemployed but looking for work, and another 13% were not looking to employment opportunities. Of the remaining students who were employed (68%), nearly 9% were employed as work–study students on campus and 91% held off-campus positions.

Looking at parents' education, high school graduates made up the highest percentage of parents' education level (31.1% for mothers and 36.5% for fathers). Approximately 13.3% of fathers and 10.7% of mothers had less than a high school education, and 17.2% of fathers had a bachelor's degree or higher as compared to 19.6% of mothers.

Financially speaking, 30.9% of the students had no loans, whereas the remainder had an average of nearly $4,000 in loans. In fact, over 22% of the students had over $6,000 in

loans for the first year, half of those having over $10,000 in aid that needed to be repaid. Moreover, about 28% of students had no scholarships or grants, and the remaining students had an average of nearly $2,000 in aid that didn't need to be repaid.

Additional demographics by transfer category (no intent to transfer, intent to transfer in a non-STEM field, and intent to transfer in a STEM field) are provided in Table 4.1. Although men made up only 27.3% of the sample, they comprised 38.9% of all those who were planning to transfer in a STEM field. In addition, although 46.2% of the student sample was 24 years of age or younger, 49.1% of those entering the STEM field were in that age category. Further, both African-Americans and Asians were more heavily represented in the STEM transfer category than they were in the population as a whole.

Those students who took more math and science classes while at the community college also were more likely to have intent to transfer into STEM fields than was the

Table 4.1

Demographics

			Transfer intent					
	Total		No		Yes: Non-STEM		Yes: STEM	
Variable	*n*	Valid %	*n*	Valid %	*n*	Valid %	*n*	Valid %
Gender								
Male	1,278	27.3	473	23.9	454	25.3	340	38.9
Female	3,404	72.7	1,505	76.1	1,340	74.7	533	61.1
Total	4,682		1,978		1,794		873	
Missing (nonresponses)	458		14		13		10	
Age								
18–24	2,111	46.2	692	34.9	972	54.2	428	49.1
25–29	685	15.0	298	15.1	261	14.5	122	14.0
30–39	1,011	22.1	492	24.8	321	17.9	191	21.9
40–55	570	12.5	413	20.9	224	12.5	121	13.9
>55	195	4.3	85	4.3	16	0.9	9	1.0
Total	4,572		1,980		1,794		871	
Missing (nonresponses)	457		12		13		12	

Table 4.1 (continued)

Variable	Total		Transfer intent: No		Transfer intent: Yes: Non-STEM		Transfer intent: Yes: STEM	
	n	Valid %	*n*	Valid %	*n*	Valid %	*n*	Valid %
Marital status								
Married	1,303	27.8	665	33.6	410	22.9	220	25.2
Living together	658	14.1	297	15.0	249	13.9	108	12.4
Single, nev married	2,169	46.4	736	37.2	967	53.9	448	51.4
Divorced/separated	549	11.7	280	14.2	168	9.4	96	11.0
Total	4,679		1,978		1,794		872	
Missing (nonresponses)	461		14		13	.7	11	
Race/ethnicity								
Native American	33	0.7	9	0.5	17	0.9	7	0.8
Asian	91	1.9	22	1.1	36	2.0	32	3.7
Black/African American	191	4.1	55	2.8	84	4.7	48	5.5
Hispanic	122	2.6	50	2.5	51	2.8	19	2.2
Native Hawaiian/ Pacific Islander	10	0.2	5	0.3	3	0.2	2	0.2
White	4,037	86.1	1,758	89.0	1,526	84.7	725	82.9
Two or more races	161	3.4	62	3.1	68	3.8	30	3.4
Unknown	43	0.9	14	0.7	16	0.9	12	1.4
Total	4,688		1,975		1,801		875	
Missing (nonresponses)	452		17		6		8	
Distance from college to permanent home								
5 miles or less	956	20.4	397	20.0	399	22.2	154	17.7
6–10 miles	961	20.5	372	18.8	382	21.2	197	22.6
11–50 miles	2,138	45.6	949	47.9	783	43.5	390	44.8
51–100 miles	393	8.4	187	9.4	124	6.9	80	9.2
101–500 miles	184	3.9	62	3.1	83	4.6	38	4.4
Over 500 miles	58	1.2	15	0.8	29	1.6	12	1.4
Total	4,690		1,982		1,800		871	
Missing (nonresponses)	450		10		7		12	
Highest level of education completed by father								
Elem School or <	182	3.6	92	4.7	46	2.6	27	3.1
Some high school	489	9.7	218	11.0	157	8.7	79	9.0
High school graduate	1,845	36.5	777	39.3	631	35.1	297	33.8
Some college	804	15.9	285	14.4	304	16.9	161	18.3
Assoc degree	606	12.0	233	11.8	224	12.5	97	11.0
Bachelors degree	556	11.0	173	8.7	227	12.6	110	12.5
Some graduate school	40	0.8	14	0.7	10	0.6	10	1.1
Graduate degree	274	5.4	73	3.7	109	6.1	62	7.1
Don't know	262	5.2	113	5.7	89	5.0	36	4.1
Total	5,058		1,978		1,797		879	
Missing (nonresponses)	82		14		10		4	

Table 4.1 (continued)

Variable	Total		Transfer intent: No		Transfer intent: Yes: Non-STEM		Transfer intent: Yes: STEM	
	n	Valid %	*n*	Valid %	*n*	Valid %	*n*	Valid %
Highest level of education completed by mother								
Elem school or <	140	2.8	54	2.7	41	2.3	34	3.9
Some high school	400	7.9	193	9.8	116	6.5	53	6.1
High school graduate	1,565	31.1	695	35.2	511	28.5	242	27.8
Some college	956	19.0	363	18.4	357	19.9	167	19.2
Associate's degree	897	17.8	318	16.1	345	19.3	167	19.2
Bachelor's degree	628	12.5	188	9.5	258	14.4	127	14.6
Some graduate school	73	1.4	29	1.5	24	1.3	16	1.8
Graduate degree	288	5.7	86	4.4	108	6.0	58	6.7
Don't know	93	1.8	46	2.3	31	1.7	8	0.9
Total	5,040		1,972		1,791		872	
Missing (nonresponses)	100		20		16		11	
Parental income								
<$20,000	186	12.0	61	11.3	70	11.7	31	11.4
$20,000–$39,900	227	14.6	87	16.1	82	13.7	37	13.6
$40,000–$59,900	232	14.9	80	14.8	105	17.5	34	12.5
$60,000–$79,900	167	10.8	52	9.6	68	11.3	32	11.7
$80,000 or more	232	14.9	41	7.6	103	17.2	70	25.6
I do not know	508	32.7	219	40.6	172	28.7	69	25.3
Total	1,552		540		600		273	
Missing (nonresponses)	3,588		1,452		1,207		610	
Financial independence								
Yes	3,478	70.5	1,446	74.8	1,203	68.9	610	71.1
No	1,452	29.5	488	25.2	542	31.1	248	28.9
Total	4,930		1,934		1,745		858	
Missing (nonresponses)	210		58		62		25	
Aid that must be repaid (loans)								
None	1,538	30.9	564	28.6	566	31.4	289	32.8
<$1,000	160	3.2	54	2.7	71	3.9	26	3.0
$1,000–$2,999	688	13.8	264	13.4	265	14.7	119	13.5
$3,000–$5,999	1,110	22.3	456	23.1	393	21.8	189	21.5
$6,000–$9,999	571	11.5	256	13.0	197	10.9	98	11.1
$10,000+	563	11.3	245	12.4	174	9.7	117	13.3
Don't know	347	7.0	134	6.8	134	7.4	42	4.8
Total	4,977		1,973		1,800		880	
Missing (nonresponses)	163		19		7		3	

Table 4.1 (continued)

Variable	Total		Transfer intent: No		Transfer intent: Yes: Non-STEM		Transfer intent: Yes: STEM	
	n	Valid %	*n*	Valid %	*n*	Valid %	*n*	Valid %
Aid not needing to be repaid (scholarships)								
None	1,382	27.8	557	28.2	467	26.1	264	30.1
<$1,000	468	9.4	163	8.2	179	10.0	95	10.8
$1,000–$2,999	1,229	24.7	489	24.7	465	26.0	194	22.1
$3,000–$5,999	1,046	21.0	413	20.9	381	21.3	193	22.0
$6,000–$9,999	278	5.6	122	6.2	91	5.1	52	5.9
$10,000+	212	4.3	87	4.4	75	4.2	37	4.2
Don't know	356	7.2	145	7.3	133	7.4	42	4.8
Total	4,971		1,976		1,791		877	
Missing (nonresponses)	169		16		16		6	
Current work status								
Yes, on campus	303	6.1	97	4.9	127	7.0	62	7.0
Yes, off campus	3,111	62.1	1,181	59.4	1,187	65.8	531	60.2
No, not looking for work	649	13.0	298	15.0	192	10.6	121	13.7
No, but am seeking work	945	18.9	413	20.8	298	16.5	168	19.0
Total	5,008		1,989		1,804		882	
Missing (non-resp)	132		3		3		1	
No. of hours worked								
0 hours	1,594	32.2	711	35.9	490	27.3	289	32.8
1–10 hours	426	8.6	162	8.2	149	8.3	85	9.6
11–15 hours	323	6.5	120	6.1	122	6.8	58	6.6
16–20 hours	532	10.7	187	9.4	209	11.7	107	12.1
21–30 hours	788	15.9	274	13.8	331	18.5	131	14.9
>30 hours	1,290	26.0	529	26.7	492	27.4	211	24.0
Total	4,953		1,983		1,793		881	
Missing (nonresponses)	187		9		14		2	
No. of people financially supporting								
None	2,480	49.6	831	41.8	983	54.6	470	53.3
1–2 persons	1,445	28.9	668	33.6	471	26.2	220	24.9
3–4 persons	812	16.2	376	18.9	267	14.8	129	14.6
5 or above	267	5.3	112	5.6	80	4.4	63	7.1
Total	5,004		1,987		1,801		882	
Missing (nonresponses)	136		5		6		1	
Enrollment status								
Full time (≥12)	3,277	69.9	1,288	65.1	1,312	72.8	649	74.3
Part time (<12)	1,414	30.1	689	34.9	490	27.2	225	25.7
Total	4,691		1,977		1,802		874	
Missing (nonresponses)	449		15		5		9	
College math & science courses taken								
0–2 courses	3,117	60.6	1,373	63.8	1,097	60.6	359	40.7
3–6 courses	1,781	34.6	699	32.5	647	35.8	428	48.5
7–9 courses	202	3.9	64	3.0	57	3.2	79	8.9
10+ courses	40	0.8	15	0.7	8	0.4	17	1.9
Total	5,140		2,151		1,809		883	

population as a whole. In fact, nearly 11% of the intent to transfer into STEM population had taken more than six classes in those fields while at the community college and over 60% had taken at least three courses. This is compares to 36.2% in the non-transfer population and 39.4% in the transfer non-STEM population who had taken at least three math and science courses.

Comparative Statistics

Research questions 2 and 3 asked "Are there statistically significant differences between demographic variables, such as age, gender, enrollment status, ethnicity, and number of math and science courses taken, between the students who do not intend to transfer and those who intend to transfer into a non-STEM field and those who intend to transfer into a STEM field?" and "Are there statistically significant differences between financial variables, such as number of hours worked, number of dependents supported, and the amount of financial aid received between the students who do not intend to transfer, those who intend to transfer into a non-STEM field and those who intend to transfer into a STEM field?"

Demographic variables of age, gender, enrollment status and ethnicity can be measured through the use of a Pearson chi-square test, which according to Urdan (2010), is most appropriate when one has data comparing two nominal or categorical variables. Pearson chi-square tests determined if specified groups of students were more or less likely than expected to intend to transfer into a STEM field. The effect sizes of the dichotomous variables were analyzed using the phi coefficient, and the effect size of the polytomous nominal variables was determined by the use of Cramer's *V*. For quantitative variables

related to the number of college math and science courses taken as well as the financial-related variables, the most appropriate test is the discriminant analysis.

The results of the Pearson chi-square test for the dichotomous variable gender are displayed in Table 4.2. The analysis revealed that the intention to transfer to a 4-year institution in a STEM field was significantly different between male and female community college students, $\chi^2 = 75.161$, $df = 2$, $N = 4{,}658$, $p \leq .001$. The analysis indicated that students who intended to transfer to a 4-year institution in a STEM field were more likely to

Table 4.2

Pearson Chi-Square Test for Gender

		Transfer intent					
Variable	*N*	No	Yes: Non-STEM field	Yes: STEM field	χ^2	*p*	*df*
Gender					75.161	<.001	2
Male	1,269	475	454	340			
Female	3,389	1,514	1,342	533			
Total	4,658	1,989	1,796	873			

Note. Phi = .127; Zero cells (0.0%) have expected count less than 5. The minimum expected count is 237.84.

be male than female. Phi, which indicates the strength of association between the two variables, was .127. This effect size of less than .20 is considered to be small (Urdan, 2010).

A chi-square analysis also was performed to determine whether various ethnicities were proportionately represented across all three transfer intention levels, given the number of each in the sample. The analysis produced a significant chi-square value, $\chi^2 = 47.131$, $df = 14$, $N = 4{,}664$, $p \leq .001$, indicating that ethnicities were not represented proportionately in

each category of transfer intentions. This indicates that student transfer intention is dependent upon ethnicity (see Table 4.3).

As indicated in Table 4.4, a chi-square test indicated that there is a significant difference, $\chi^2 = 37.052$, $df = 2$, $N = 4{,}669$, $p \leq .001$, between enrollment status and transfer intentions. Cramer's V is .071 suggesting a small effect size, and less than 20% have a cell count of less than five. This indicates that the number of part-time and full-time status students were not represented proportionately in the categories of transfer intentions. In this sample, part-time community college students were more likely not to have any transfer intentions than were full-time students.

Table 4.3

Pearson Chi-Square Test for Ethnicity

		Transfer intent					
Variable	*n*	No	Yes: Non-STEM field	Yes: STEM field	χ^2	*p*	*df*
Ethnicity					47.131	<.001	2
Amer. Indian/ Alaskan Native	33	9	17	7			
Asian	90	22	36	32			
Black/African American	187	55	84	48			
Hispanic	120	50	51	19			
Native Hawaiian/ Pacific Islander	10	5[a]	3[a]	2[a]			
White/Caucasian	4,022	1,769	1,528	725			
Two or more races	160	62	68	30			
Unknown	42	14	16	12			
Total	4,664	1,986	1,803	875			

Note. Cramer's $V = .071$.

[a]Three cells (12.5%) have expected count less than 5. The minimum expected count is 1.88.

Table 4.4
Pearson Chi-Square Test for Enrollment Status

		Transfer intent					
Variable	*n*	No	Yes: Non-STEM field	Yes: STEM field	χ^2	*p*	*df*
Enrollment Status					37.052	≤.001	2
Part time	1,409	694	490	225			
Full time	3,257	1,294	1,314	649			
Total	4,669	1,988	1,804	874			

Note. Phi = .089; zero cells (.0%) have expected count less than 5. The minimum expected count is 263.92.

Similarly, the same test was used to determine whether there were any significant differences in transfer intention between those who had a parent with a bachelor's degree and those who did not. The results, $\chi^2 = 30.263$, $df = 2$, $N = 4{,}842$, $p \leq .001$, suggest that community college students with intentions to transfer into a STEM field are more likely to have a parent with a bachelor's degree than are those students in the other transfer categories (see Table 4.5). Phi indicates a small effect size of .089 and no cells have an expected count of less than 5.

Table 4.5
Pearson Chi-Square Test for Parent Education

		Transfer intent					
Variable	*n*	No	Yes: non-STEM field	Yes: STEM field	χ^2	*p*	*df*
Parent with bachelor's degree					30.263	<.001	2
No	3,420	1,605	1,227	588			
Yes	1,423	546	582	295			
Total	4,842	2,151	1,809	883			

Note. Phi = 0.079; zero cells (.0%) have expected count less than 5. The minimum expected count is 259.45.

To see if the quantitative variables had any significant differences among categories of the dependent variable, a classification technique was chosen. According to Mertler and Vannatta (2010), discriminant analysis often is seen as the reverse of multivariate analysis of variance in that it seeks to identify which combination of quantitative independent variables best predicts group membership as defined by a single dependent variable with two or more categories.

Specifically, the discriminant analysis was conducted to determine whether four variables—number of hours spent working, amount of financial loans received, number of dependents supported, and number of college math and science courses taken—could predict students' intentions to transfer to a 4-year college or university in a STEM field. Prior to analysis, outliers were removed using the Mahalanobis distance test, $\chi^2(4) = 18.46$, $p = .001$. In addition, a scatterplot of standardized predicted values by standardized residuals was utilized to check for linearity and normality. Residuals were concentrated in the center of the plot and were linear in nature, thus assuming normality and linearity conditions were met.

Examination of the analysis of variance results from the tests of equality of group means table from the discriminant analysis output is helpful in determining if groups differ significantly within each independent variable. Table 4.6 includes the Wilks' lambda, *F* test, degrees of freedom and *p* values for each independent variable. From these results, it can be determined that financial aid received ($p < .004$), number of dependents supported ($p < .001$) and college math and science courses taken ($p < .001$) show significant group differences, whereas number of hours worked ($p < .124$) does not.

Table 4.6

Discriminant Analysis Tests of Equality of Group Means

	Wilks' lambda	*F*	*df*1	*df*2	Sig.
Financial aid received	.997	5.517	2	3188	.004
No. of dependents supported	.992	12.895	2	3188	.000
No. of hours spent working	.999	2.090	2	3188	.124
No. of math and science courses taken	.958	69.065	2	3188	.000

After estimating the discriminant model, two functions were generated and the overall Wilks' lambda was significant, $\Lambda = .946$, $\chi^2 = 29.421$, $df = 8$, $N = 3318$, $p < .001$, and $\Lambda = .991$, $\chi^2 = 175.858$, $df = 8$, $N = 3318$, $p < .001$. This indicates that there was significant difference between those students who didn't intend to transfer at all and those who were intending to transfer in STEM fields.

Original classification results revealed that 50.6% of those students who did not intend to transfer were correctly identified, 54.9% of those who intended to transfer in non-STEM areas were correctly identified, and only 11.8% of those who intended to transfer to a 4-year institution in a STEM field were classified correctly. Cross-validation yielded similar results of 50.5%, 54.6%, and 11.6%, respectively. For the overall sample, 45.3% were correctly classified, whereas 45.0% accuracy was derived from cross-validation (see Table 4.7). In examining the functions of group centroid table, it was found that the means of the discriminant function were consistent with these results. Students with no transfer intentions had a function mean of –.150, whereas students with transfer intentions in non-STEM fields had a function mean of –.050 and students with transfer intentions in STEM fields had a function mean of .448. Those students who had intended to transfer into STEM were more

Table 4.7

Discriminant Analysis Classification Results

	Predicted group membership			
DV	0.00	1.00	2.00	Total
Original				
Count				
0.00	665	593	55	1313
1.00	524	710	60	1294
2.00	216	299	69	584
Ungrouped cases	66	59	2	127
%				
0.00	50.6	45.2	4.2	100.0
1.00	40.5	54.9	4.6	100.0
2.00	37.0	51.2	11.8	100.0
Ungrouped cases	52.0	46.5	1.6	100.0
Cross-validated				
Count				
0.00	663	595	55	1313
1.00	528	706	60	1294
2.00	217	299	68	584
%				
0.00	50.5	45.3	4.2	100.0
1.00	40.8	54.6	4.6	100.0
2.00	37.2	51.2	11.6	100.0

Note. 45.3% of original grouped cases correctly classified; 45.0% of cross-validated grouped cases correctly classified.

likely to have taken more college math and science courses, to have less financial aid, and to be supporting fewer dependents.

Inferential Statistics

Research questions 4 and 5 were related to the significance of financial and social/cultural capital factors on the endogenous variable. These questions were addressed using exploratory and confirmatory factor analysis as well as SEM. According to Byrne (2010), this method is a confirmatory, hypothesis-testing approach to test the structural theory bearing on some phenomenon. This type of methodology allows testing of the direct, indirect, and total effects of exogenous variables on an endogenous variable. It also allows

the researcher to study those theoretical (latent) constructs that can't be observed directly (Byrne, 2010).

Data Assumptions

When considering the use of any statistical methodology, the researcher must first be aware of statistical assumptions that must be met. For SEM these assumptions include: (a) correct specification of the model, (b) multivariate normality, (c) independence of exogenous variables, (d) a properly identified model, (e) no systematic missing data, and (f) a sufficiently large sample size.

Model specification. According to Kline (2011), model specification is the most difficult part of SEM. The researcher must have sound reasoning for inclusion of specific variables and the specification of the model paths. Therefore, structural models must be informed by previous research and based upon a solid understanding of the issues surrounding the criterion variable.

Normality of data. SEM programs assume that dependent and mediating variables are continuously distributed with normally distributed residuals. It is common in the social sciences to use categorical variables in path analysis, although this requires assumptions of normality (Olobatuyi, 2006). Likert scales are also acceptable if the data can be justified as approximating interval levels (Walker & Maddan, 2009, Chapter 4). All variables in this study were either categorical or in a Likert-type scale. Tests for normality include skew and kurtosis normality checks. Univariate skew values between –2 and 2 and univariate kurtosis values between –7 and 7 are evidence that the data fall within an acceptable normal distribution range (Curran, West, & Finch, 1996). For this study, only two variables fell outside those values. Question 20_3 relating to employer contributions to college finances

and Question 20_6 relating to other sources of financial aid not listed were removed from the financial aid construct. See Table 4.8 for normality results of the study's variables.

However, when all individual variables are normally distributed, the set of variables may not be distributed as multivariate normal. Hence, testing each variable only for univariate normality is not sufficient. Mardia (as cited in Garson, 2012) proposed tests of multivariate normality based on sample measures of multivariate skewness and kurtosis. Amos provides a test for Mardia's coefficient of multivariate kurtosis. Mardia coefficient values greater than 1.96 indicates there is significant kurtosis, which means significant non-normality (Garson, 2012).

Lack of multivariate normality usually inflates the chi-square statistic such that the overall chi-square fit statistic for the model as a whole is biased toward Type I error (rejecting a model that should not be rejected; Garson, 2012). Amos allows one to test this using ADF (asymptotically distribution-free) analysis rather than maximum likelihood (ML), as ADF does not assume multivariate normality. However, after running the final model using both types of analysis, the chi-square statistic remained virtually unchanged. This is likely due to the extremely large sample size (Garson, 2012).

Independence of exogenous variables. Kline (2011) suggested that multicollinearity, particularly within a single construct, can be addressed quickly and simply by examining the correlation matrix. Correlations greater than .85 are suggestive of possible multicollinearity. Another way to test the collinearity issues are with the diagnostics tool in SPSS. Variance inflation factor (VIF) results of less than 3 are acceptable (Mertler &

Table 4.8.

Normality Results

Measured variables	Skewness Value	Skewness *SE*	Kurtosis Value	Kurtosis *SE*
Latent variable: Parent involvement in HS				
Work with you on your homework	–1.008	.034	–0.447	.068
Discuss your progress in school	–1.329	.034	0.570	.068
Spent time just talking to your friends	–0.382	.034	–1.200	.068
Eat main meal with you at table	–0.144	.034	–1.414	.068
Latent variable: Parent education				
Mother education	0.553	.034	–0.034	.068
Father education	0.734	.034	0.171	.068
Latent variable: Access to institutional agents				
I consulted with academic advisors/counselor regarding transfer	–0.094	.034	–1.263	.068
Information received from academic advisors/counselors was helpful in the transfer process	–0.188	.034	–0.956	.068
I met with academic advisors/counselors on a regular basis.	0.276	.034	–1.086	.068
Advisors/counselors identified courses needed to meet the general education/major requirements of a 4-year college or university I was interested in attending	–0.196	.034	–1.207	.068
Latent variable: Financial concerns				
How likely would each of the following be to prevent you from obtaining your college degree?: Debt-need to work more hours because of bills	0.096	.034	–1.285	.068
How likely would each of the following be to prevent you from obtaining your college degree?: Insufficient financial aid	0.128	.034	–1.277	.068
How likely would each of the following be to prevent you from obtaining your college degree?:Lack of money	–0.137	.034	–1.200	.068
Latent variable: Environmental pull factors				
How likely would each of the following be to prevent you from obtaining your college degree?: Inability to balance home and school responsibilities	0.614	.034	–0.678	.068
How likely would each of the following be to prevent you from obtaining your college degree?: Inability to balance work and school responsibilities	0.539	.034	–0.812	.068
Latent variable: Financial aid				
How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to . . . : Aid which need not be repaid (grants, scholarships, military funding, etc.)	0.266	.034	–0.809	.068
How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to . . . : Aid which must be repaid (loans, etc.)	0.072	.034	–1.301	.068

Vannatta, 2010). In this study, none of the correlations were above .85, and the VIF tests were below 3. See Appendix E for the correlation matrix.

Model identification. SEM programs require an adequate number of known correlations or covariances as inputs in order to generate a sensible set of results. An additional requirement is that each equation be properly identified. Models for which there is only one possible solution for each parameter estimate are said to be *just-identified.* Models for which there are an infinite number of possible parameter estimate values are said to be *underidentified.* Finally, models that have more than one possible solution (but one best or optimal solution) for each parameter estimate are considered *overidentified* (Byrne, 2010). Amos performs identification checks as part of the model-fitting process. It provides reasonable warnings about underidentification conditions so that one can remedy the situation and respecify the model.

Missing data. Because SEM modeling in AMOS requires complete data for modification indices and other analyses, several methods have been proposed for dealing with these missing data. The most typical ways of handling missing data are not appealing from a statistical point of view. For instance, listwise deletion can result in a substantial loss of power, particularly if many cases each have a few data points missing on a variety of variables, not to mention limiting statistical inference to individuals who complete all measures in the database. Pairwise deletion is marginally better, but the consequences of using different numbers of observations for each covariance or correlation can have profound consequences for model fitting efforts. Finally, mean substitution will shrink the variances of the variables where mean substitution took place, which also is not ideal. These methods

can lead to a number of bad statistical properties including underestimated standard errors and biased parameter estimates (Little & Rubin, 1989; Rubin, 1987; Schafer, 1997).

For this study AMOS's built-in function for full information multiple likelihood (FIML) estimation for imputation was used. FIML uses all available data (i.e., variables selected for imputation) and requires that the researcher specify a model for the joint distribution of the variables (specified as multivariate normal in this study), computes the likelihood of the observed data as a function of the parameters for the fixed observed data, and estimates the parameters that maximize this likelihood (Little & Rubin, 1989). Computationally, this can be summarized using the following equation, which maximizes the casewise likelihood of the observed data by minimizing the following function:

$$C(\gamma) = \sum_{i=1}^{N} \log |\Sigma_{i,mm}| + \sum_{i=1}^{N} (\mathbf{y}_{i,m} - \mu_{i,m})' \Sigma^{-1}_{i,mm} (\mathbf{y}_{i,m} - \mu_{i,m}),$$

where $y_{i,m}$ is the observed elements in the data vector for case i, and $\mu_{i,m}$ and $\sum_{i,mm}$ are the corresponding mean vector and covariance matrix parameters (Arbuckle, 1995). Garson (2012) recommended that, in the case of ordered categorical data, Bayesian estimation is more appropriate than the ML approach. The Bayesian approach is similar to the ML approach except that it assumes that parameter values are estimated and not known. In this study, both methods were tested on the final SEM model and both imputation methods produced similar results. This finding is supported by Byrne (2010) who stated, "Where the hypothesized model is well specified and the scaling based in more than three categories, it seems unlikely that there will be much difference between the findings" (p. 160).

Sample size. According to James Stevens's (2001) *Applied Multivariate Statistics for the Social Sciences*, for sample size a good guideline is 15 cases per predictor in a standard

ordinary least squares multiple regression analysis. Given that SEM is closely related to multiple regression in some respects, 15 cases per measured variable in SEM is not unreasonable. This dataset had 5,140 cases, which clearly was enough for even a very complex model. The one drawback to large sample sizes is that the chi-square is susceptible to over-inflation (Kline, 2011) and, as such, increases the likelihood of failing to reject the null hypothesis.

Exploratory Factor Analysis

Exploratory factor analysis allows one to test the correlations among factors. Using SPSS 20.0, an EFA analysis was conducted to determine what, if any, underlying structure existed amongst observed variables. The initial factor analyses, using principal components extraction with a varimax factor rotation produced the results shown in Tables 4.9, 4.10, and 4.11 for the latent constructs of social capital, finances, and environmental pull (respectively). According to Kline (2011), a factor loading around .90 is excellent, .80 is very good, .70 is adequate, .60 is questionable, and around .50 and lower is considered unacceptable. Thus, all variables below .60 were considered unacceptable and were removed from the tables.

Confirmatory Factor Analysis

To evaluate the model fit when using CFA and SEM, it is necessary to use the modification index values, the chi-square goodness-of-fit statistic, and fit indexes. The methods used in this study are described in further detail below along with the results of the analysis.

Table 4.9

Exploratory Factor Analysis Loadings for Social Capital Factors

Factor	Factor Loadings 1	2	3
Section 2: Social Capital What is the highest level of education completed by your parents?-Mother			.785
Section 2: Social Capital What is the highest level of education completed by your parents?-Father			.818
During high school, how often did your parents or other adults:			
Participate in school related activities (e.g., Parent-Teacher Association)	.694		
Spend time talking with your friends	.715		
Discuss book, films, or television programs with you	.653		
Eat the main meal with you around a table	.601		
Spend time just talking to you	.725		
Work with you on your homework	.739		
Discuss your progress in school with you	.793		
The following items address your use of academic advising/counseling services at your community college. Please indicate the extent to which you disagree or agree with each statement:			
I consulted with academic advisors/counselor regarding transfer.		.777	
Information received from academic advisors/counselors was helpful in the transfer process.		.788	
I met with academic advisors /counselors on a regular basis.		.688	
I talked with an advisor/counselor about courses to take, requirements, and education plans.		.689	
Advisors/counselors identified courses needed to meet the general education/major requirements of a four-year college or university I was interested in attending.		.757	

Modification indices. These indices identify covariances between variables and can be used to alter models to achieve better fit, when there is theoretical justification for doing so. Garson (2012) recommended considering only paths whose modification index exceeds 100 and has substantive theory behind it.

Table 4.10

Exploratory Factor Analysis Loadings for Financial Factors

Factor	Factor Loadings 1	2
How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to cover from . . .		
Family resources (parents, relatives, spouse, etc.)		–.621
Aid which need not be repaid (grants, scholarships, military funding, etc.)		.741
Aid which must be repaid (loans, etc.)		.619
How likely would each of the following be to prevent you from obtaining your college degree?		
Debt-need to work more hours because of bills	.802	
Insufficient financial aid	.862	
Lack of money	.897	
Do you have any concern about your ability to finance your college education?	.727	

Table 4.11

Exploratory Factor Analysis Loadings for Environmental Pull Factors

Factor	Component 1	2
How likely would each of the following be to prevent you from obtaining your college degree?		
Inability to balance home and school responsibilities	.893	
Inability to balance work and school responsibilities	.896	
Excluding yourself, how many people (children, grandchildren, brothers, sisters, parents, etc.) are you financially supporting		–.699
Hours worked		.720

Model fit statistics. The two most popular ways of evaluating model fit are those that involve the chi-square goodness-of-fit statistics and fit indexes. The chi-square goodness-of-fit statistic assesses the magnitude of discrepancy between the sample and fitted covariance matrices. However the chi-square statistic may not be a very good fit index as it is affected

by larger sample size, which produces larger chi-squares that are more likely to be significant (Type I error). The chi-square is susceptible to over-inflation with large sample sizes (Kline, 2011) and, as such, increases the likelihood of failing to reject the null hypothesis. Conversely, a sample size that is too small is likely to result in rejection of a correct null hypothesis (Type II error). Therefore, researchers using SEM must not rely solely on the chi-square statistic to determine appropriate model fit.

Another way to assess goodness-of-fit is to use a fit index. A fit index can be used to quantify the degree of fit along a continuum. Fit indices can be either absolute or incremental fit indices (Hu & Bentler, 1999). This research study used an absolute fit index called the root mean square error of approximation (RMSEA) and an incremental fit index called Bentler's Comparative Fit Index (CFI). In addition, the chi-square and degrees of freedom for model fit evaluation will be provided. Cut-off values for each are discussed below.

Root mean square error of approximation. RMSEA was designed to account for varying sample size. As such, it is considered a parsimony-adjusted index. A value of zero is considered the best fit, with higher numbers suggesting an increasingly worse fit. Results less than .06 are considered a good fit (Hu & Bentler, 1999).

Comparative fit index. The CFI ranges from zero to 1.00 and is derived from the comparison of a hypothesized with the independence (or null) model. Although a value greater than .90 originally was considered representative of a well-fitting model, Hu & Bentler (1999) now have suggested a cut-off value closer to .95. Byrne (2010) stated that, of the two indexes (NFI and CFI), CFI should be considered the index of choice.

Results. Based on a review of the literature and results of EFA in SPSS 20.0, several latent constructs were tested. The original social capital CFA tested did not include any covariance among the indicators (CMIN/*df* = 30.554, *df* = 54, CFI = .932, RMSEA = .076). Using the Amos 20.0 modification indices, covariance paths were added among the error terms to improve the model fit (CMIN = 459.813, CMIN/*df* = 9.783, *df* = 47, CFI = .982, RMSEA = .041). The *p*-values were all significant at the .001 level except for the path from e8 to e10, which was significant at .008. The model is represented in Figure 4.1.

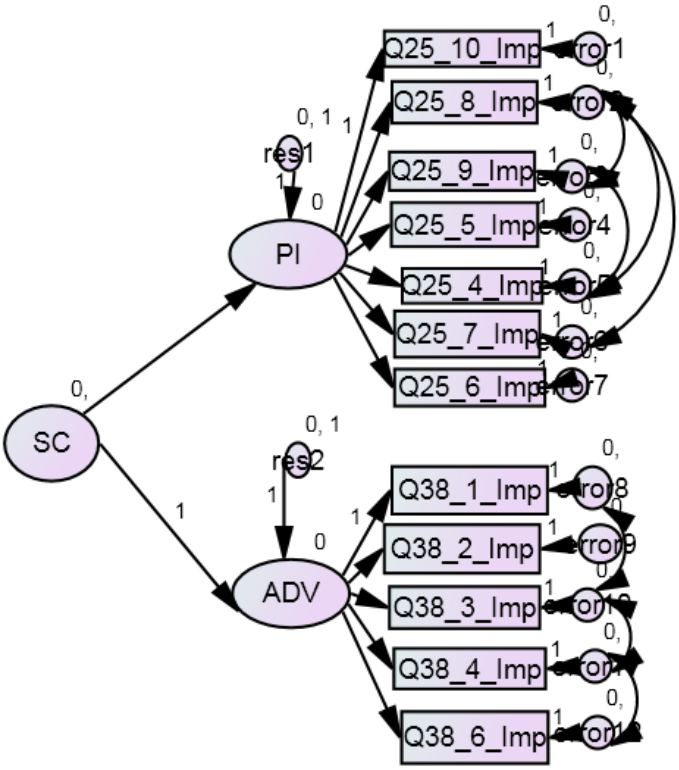

Figure 4.1. Social capital construct with parent involvement (PI) and community college advising (ADV) latent constructs.

The next CFA developed was based on the first-order financial constructs, including one for financial concerns (CMIN=77.696, CMIN/*df* = 38.848, *df* = 2, CFI = .992, RMSEA = .086) and one for financial aid including family resources, aid that did not need to be repaid (grants/scholarships), and aid that did need to be repaid, such as loans (CMIN = .558, CMIN/*df* = .558, *df* = 1, CFI = 1, RMSEA = .000). The second construct was modified for a better fit by adding a covariance between two of the error terms, thus losing a degree of freedom and producing a better fit. The final models are represented in Figures 4.2 and 4.3.

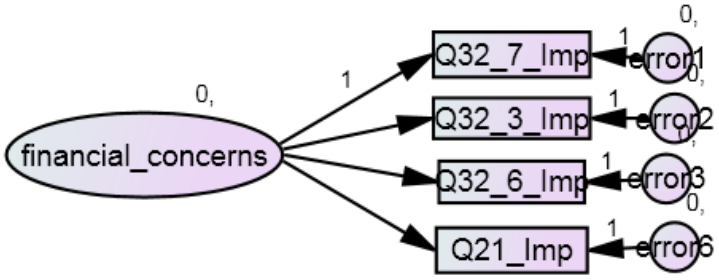

Figure 4.2. Financial concerns construct.

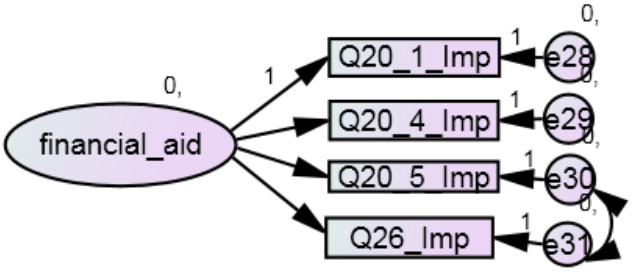

Figure 4.3. Financial aid construct.

The environmental pull factor construct loaded highly for four components, including number of dependents supported, number of hours worked, and two questions regarding inability to balance home and school and work and school. The first model was run without any covariance among the indicators (CMIN/*df* = 67.040, *df* = 2, CFI = .960, RMSEA =

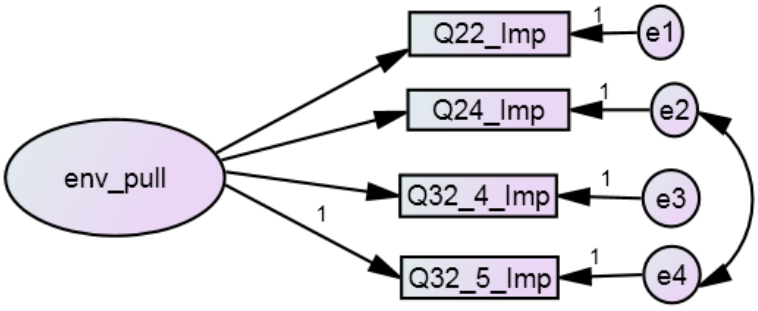

Figure 4.4. Environmental pull construct.

.113). After adding a covariance, the new model showed an improved fit (CMIN = 50.233, CMIN/*df* = 50.233, *df* = 1, CFI = .985, RMSEA = .098; see Figure 4.4.

Measurement Model

Having confirmed the latent constructs, the full SEM measurement model was then developed. The final hypothesized model is represented in Figure 4.5. As previously, circles represent latent variables and rectangles represent measured variables. Absence of a line connecting variables implies lack of hypothesized direct effect.

The hypothesized model, derived from a review of the literature, examined the effect of the predictors on the endogenous variable, the intention to transfer to a 4-year institution in a STEM field, which is represented by a multinomial value of 0 for not transfer, 1 for transfer in a non-STEM field, and 2 for transfer in a STEM field. It was hypothesized that the latent constructs social capital and environmental pull factors as well as the observed variables of academic preparation, financial loans, grants, and aid would directly predict intent to transfer to a 4-year college or university in a STEM field.

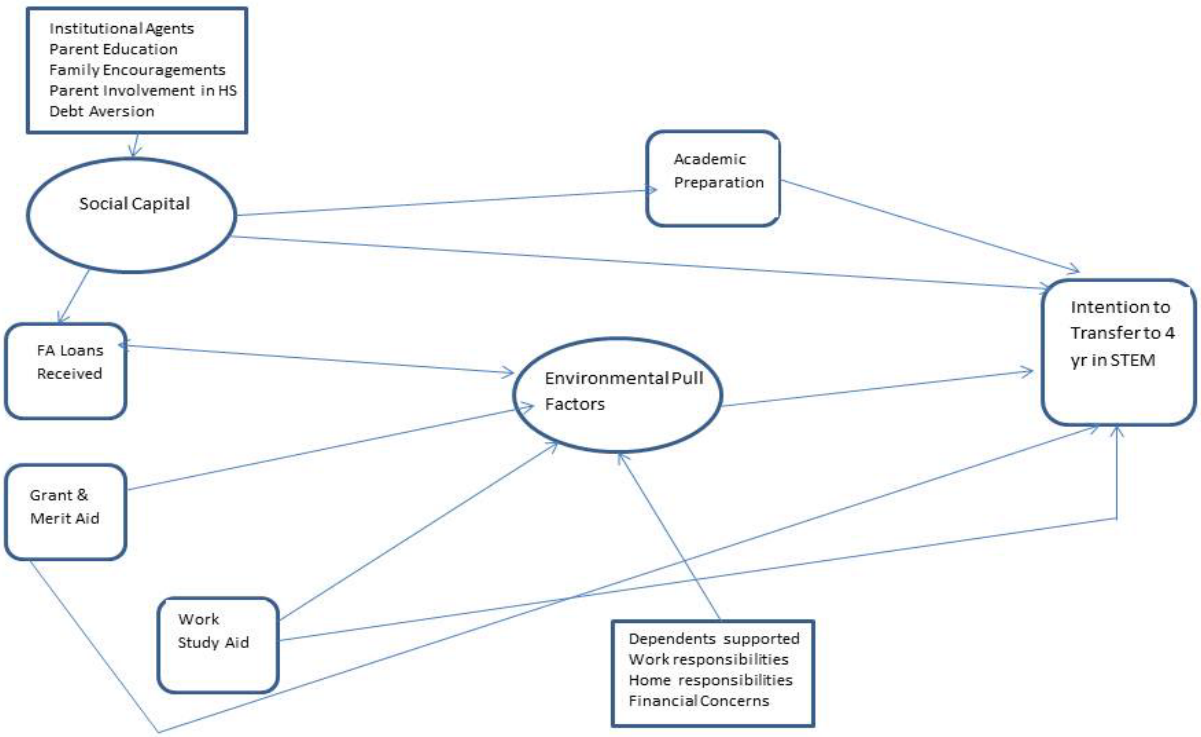

Figure 4.5. Revised Kruse hypothetical model based on Cabrera et al.'s (1992) integrated model of student retention and variables related to social capital (Bourdieu, 1973, 1986), finances, and debt aversion.

Structural Equation Model

Through the use of the CFA, there was more confidence that the measurement model was operating adequately and the hypothesized structural equation model could be further assessed (Byrne, 2010). According to the results of the first CFA, it was determined that the latent variable social capital was a second-order construct measured by the latent variables of access to community college advisors (otherwise known as institutional agents in the literature) and parent involvement in high school. Conceptually, the literature suggests that these latent variables influence the degree of students' social capital. Parent involvement initially had seven indicators and community college advising had five indicators.

Additionally, the latent variables financial aid and financial concerns each had three indicators and environmental pull factors had four (see Figure 4.6).

This model produced a marginal fit (CMIN = 4364.10, CMIN/*df* = 16.657, *df* = 262, CFI = .899, RMSEA = .055). Upon examining the modification indices and drawing covariances among the financial concerns and financial aid and between environmental pull factors and both financial constructs as well as between financial concerns and social capital, the model fit was further improved (CMIN = 2823.133, CMIN/*df* = 10.830, *df* = 254, CFI = .938, RMSEA = .044).

Next the regression weights were examined. These weights use observed information to calculate the change that will be produced in an outcome variable relative to a fixed amount of change in a predictor variable. In this model, they all showed significant *p*-values of less than .001 except for two variables, which showed significant values of .002 and .003, in addition to a nonsignificant relationship between the endogenous variable and the environmental pull construct ($p > .603$; see Table 4.12). To allow for a more parsimonious fit, this construct was removed from the model (CMIN = 1512.675, CMIN/*df* = 8.595, *df* = 176, CFI = .961, RMSEA = .038). With the removal of the environmental pull construct, the significance of the covariance between social capital and financial concerns decreased from marginally significant at .012 to not significant at .136, so that also was removed.

Next came the addition of several observed variables including family encouragement, parent education, and working on campus in a work–study position. The first two variables have been correlated with social/cultural capital in the literature, and the latter variable was kept separate from the other financial aid variables to test its direct effect on the endogenous variable.

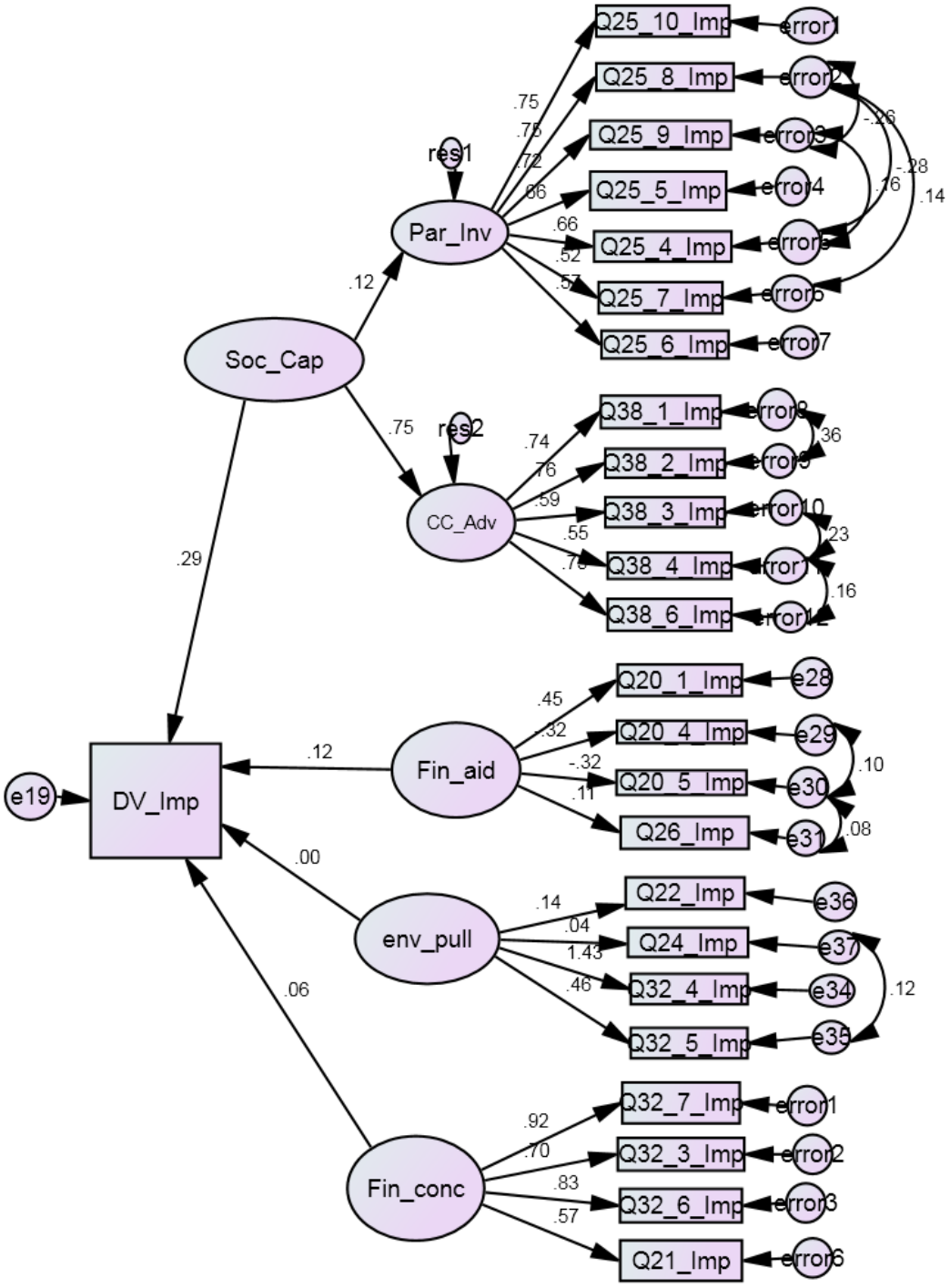

Figure 4.6. SEM model #1.

In this model, paths were drawn from parent education to parent involvement in high school and to financial aid; in addition, a direct path was drawn from parent education to the endogenous variable intent to transfer to a 4-year college in a STEM field. Family encouragement and support also was shown to have an effect on social capital, parent involvement in high school and a direct path to the endogenous dependent variable, intent to transfer to a 4-year college in a STEM field. The modification indices also indicated a need to remove the double arrow between social capital and financial concerns. Next, the work–study variable was added to the model and was found to have an indirect relationship on social capital through community college advising and proved to have a weak but significant direct path to the endogenous variable. In the final model, college math and science preparation (total number of college math and science courses taken) also was found to have a significant effect on intent to transfer (CMIN = 1603.643, *df* = 236, CFI = –.961, CMIN/*df* = 6.793, RMSEA = .034). The model improved each step along the way.

It was noted that some variables within the latent constructs were loading at the marginal level, including Question 25_7 (.52 loading) and Question 25_6 (.58 loading) within the parent involvement construct as well as Question 28_3 (.59 loading) and Question 28_4 (.56 loading) within the community college advising construct. Within the financial concerns, Question 21 loaded marginally with a coefficient of .57, and the removal of Question 20_1 in the financial aid construct also removed for a better fit. Due to the decrease in degrees of freedom and the simplification of the model, the chi-square statistic decreased significantly in the final model and the model fit statistics improved slightly (CMIN = 718.974, CMIN/*df* = 5.893, CFI = .976 and RMSEA = .031). One last note about this model: The parameter from parent education to the dependent variable was removed because it

Table 4.12

Regression Weights for SEM Model #2

Exogenous variables		Endogenous variables	Estimate	*SE*	Critical ratio	*p*	Label
PI	<—	SC	0.099	0.020	5.026	***	par_11
ADV	<—	SC	1.000				
Q25_10_Imp	<—	PI	1.000				
Q25_8_Imp	<—	PI	0.922	0.016	56.419	***	par_1
Q25_9_Imp	<—	PI	1.047	0.019	53.956	***	par_2
Q25_5_Imp	<—	PI	0.958	0.018	52.640	***	par_3
Q25_4_Imp	<—	PI	0.955	0.020	47.498	***	par_4
Q25_7_Imp	<—	PI	0.727	0.020	36.946	***	par_5
Q25_6_Imp	<—	PI	0.882	0.020	43.377	***	par_6
Q38_1_Imp	<—	ADV	1.000				
Q38_2_Imp	<—	ADV	0.955	0.016	59.274	***	par_7
Q38_3_Imp	<—	ADV	0.736	0.022	33.538	***	par_8
Q38_4_Imp	<—	ADV	0.690	0.024	28.766	***	par_9
Q38_6_Imp	<—	ADV	1.002	0.028	36.157	***	par_10
Q32_7_Imp	<—	financial_concerns	1.000				
Q32_6_Imp	<—	financial_concerns	0.935	0.013	72.550	***	par_12
Q21_Imp	<—	financial_concerns	0.413	0.009	43.868	***	par_13
Q32_3_Imp	<—	financial_concerns	0.804	0.013	59.915	***	par_14
DV_Imp	<—	financial_concerns	0.075	0.017	4.354	***	par_15
DV_Imp	<—	SC	0.187	0.016	11.798	***	par_16
Q20_1_Imp	<—	financial_aid	1.000				
Q20_4_Imp	<—	financial_aid	–0.907	0.122	–7.451	***	par_25
Q20_5_Imp	<—	financial_aid	–1.979	0.207	–9.546	***	par_26
Q26_Imp	<—	financial_aid	0.215	0.068	3.161	.002	par_27
DV_Imp	<—	financial_aid	0.222	0.052	4.293	***	par_30
Q32_4_Imp	<—	env_pull	0.860	0.024	36.191	***	par_31
Q32_5_Imp	<—	env_pull	1.000				
Q24_Imp	<—	env_pull	0.128	0.043	2.939	.003	par_32
Q22_Imp	<—	env_pull	0.306	0.030	10.074	***	par_33
DV_Imp	<—	env_pull	–0.008	0.015	–0.520	.603	par_34

Table 4.13

Final SEM Model Loadings and Variances

1st order	2nd order	Variable	Loading	Significance	Variance Explained	Variance Error
Social capital	Parent involvement in high school	25_10	0.74	***	0.55	0.45
		25_8	0.76	***	0.57	0.43
		25_9	0.75	***	0.56	0.44
		25_5	0.64	***	0.41	0.59
		25_4	0.66	***	0.44	0.56
Social capital	Community college advising	38_1	0.78	***	0.61	0.39
		38_2	0.80	***	0.65	0.35
		38_6	0.70	***	0.49	0.51
	Financial aid	20_4	0.12	***	0.01	0.99
		20_5	0.29	***	0.09	0.91
		32_7	0.94	***	0.87	0.13
	Financial concerns	32_3	0.70	***	0.48	0.52
		32_6	0.82	***	0.67	0.33

***$p < .001$.

changed from being marginally significant at the .05 level to being nonsignificant (.070) in the final model. See Table 4.13 and Figure 4.7 for the final SEM model.

Results for indirect and direct effects. The decomposition of the effects, which include direct and indirect effects of the latent and observed variables on intent to transfer into STEM, is presented in Table 4.14. Beyond the direct effects of the variables to the dependent variable, some interesting findings resulted from the decomposition of all direct and indirect effects of the exogenous variables. For instance, the indirect effects of work–study, family encouragement, and social capital on college math and science preparation were .043, .012, and 2.263 respectively, findings that are all significant at the .001 level. This means when social capital increases by 1, college math and science preparation goes up by 2.263. This is in addition to any direct (unmediated) effect that social capital may have on that variable.

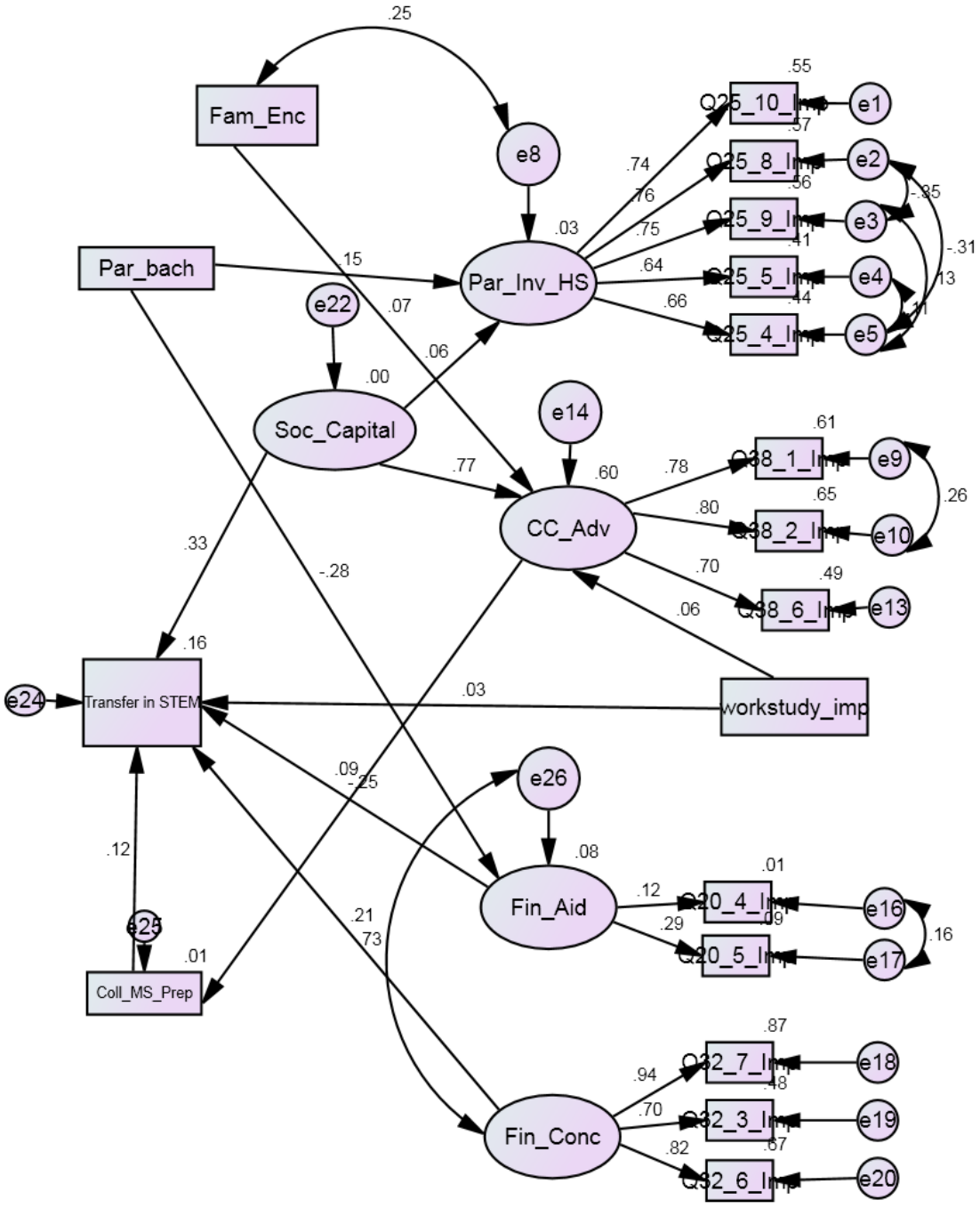

Figure 4.7. Final SEM model.

Table 4.14.

Total, Direct, and Indirect Effects

Effects	Fin_ Aid	Fin_Con c	Work– study	Fam_ Enc	Soc_ Capital	Par_ bach	CC_ Adv	College_ MS_Prep	Par_ Inv_ HS
CC_Adv	—	—	0.367**	0.103**	18.75*	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	0.366**	0.103**	19.18**	—	—	—	—
College_MS_Prep	—	—	—	—	—	–0.106**	0.118**	—	—
	—	—	0.043**	0.012**	2.212**	—	__	—	—
	—	—	0.043**	0.012**	2.212**	–0.106**	0.118**	—	—
Par_Inv_HS	—	—	—	—	1.000	0.323**	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	1.000	0.323**	—	—	—
DV_Imp	–1.024**	0.151**	0.099*	—	3.693*	—	—	0.039**	—
	—	—	0.002**	—	0.087*	0.108**	0.005**	—	—
	–1.024**	0.074**	0.101*	—	3.800*	—	0.005**	0.039**	—
Q32_6_Imp	—	0.884**	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	0.884**	—	—	—	—	—	—	—
Q32_3_Imp	—	0.741**	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	0.741**	—	—	—	—	—	—	—
Q32_7_Imp	—	1.000	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	1.000	—	—	—	—	—	—	—
Q20_5_Imp	2.963**	—	—	—	—	–0.313**	—	—	—
	—	—	—	—	—	–0.313**	—	—	—
	2.963**	—	—	—	—	—	—	—	—
Q20_4_Imp	1.000	—	—	—	—	—	—	—	—
	—	—	—	—	—	–0.106**	—	—	—
	1.000	—	—	—	—	–0.106**	—	—	—
Q38_6_Imp	—	—	—	—	—	—	0.898**	—	—
	—	—	0.33**	0.092**	16.844**	—	—	—	—
	—	—	0.33**	0.092**	16.844**	—	0.898**	—	—

Table 4.14. (continued)

Effects	Fin_ Aid	Fin_Con c	Work– study	Fam_En c	Soc_ Capital	Par_ bach	CC_ Adv	College_ MS_Prep	Par_ Inv_ HS
Q38_2_Imp	—	—	—	—	—	—	0.957**	—	—
	—	—	0.351**	0.098**	17.951**	—	—	—	—
	—	—	0.351**	0.098**	17.951**	—	0.957**	—	—
Q38_1_Imp	—	—	—	—	—	—	1.000	—	—
	—	—	0.367**	0.103**	18.75**	—	—	—	—
	—	—	0.367**	0.103**	18.75**	—	1.000	—	—
Q25_4_Imp	—	—	—	—	—	—	—	—	0.964**
	—	—	—	—	0.964**	0.311**	—	—	—
	—	—	—	—	0.964**	0.311**	—	—	0.964**
Q25_5_Imp	—	—	—	—	—	—	—	—	0.921**
	—	—	—	—	0.921**	0.297**	—	—	—
	—	—	—	—	0.921**	0.297**	—	—	0.921**
Q25_9_Imp	—	—	—	—	—	—	—	—	1.093**
	—	—	—	—	1.093**	0.353**	—	—	—
	—	—	—	—	1.093**	0.353**	—	—	1.093**
Q25_8_Imp	—	—	—	—	—	—	—	—	0.931**
	—	—	—	—	0.931**	0.301**	—	—	—
	—	—	—	—	0.931**	0.301**	—	—	0.931**
Q25_10_Imp	—	—	—	—	—	—	—	—	1.000
	—	—	—	—	1.000	0.323**	—	—	—
	—	—	—	—	1.000	0.323**	—	—	1.000

Note. For each item, the first row shows the direct effect, the second shows the indirect effect, and the third row shows the total effect.
*$p > .05$. **$p > .001$.

Other interesting findings are the strong indirect effects of community college advising on work–study and family encouragement. The more students had participated in work–study and had family encouragement, the more likely they were to seek out community college advising. Not very surprising were the strong indirect effects of parent education on parent involvement in high school activities, ranging from participating in school-related activities, such as parent–teacher association, to helping their child with homework and discussing their progress in school. All findings presented in Table 4.14 are significant at the .001 level, except for work–study's effect on the dependent variable for both total and direct effects, which was significant at the .05 level. All these effects were calculated using Amos's bootstrapping capabilities.

Total Variance Explained

An estimate of total variance explained by a model can be obtained by converting the path regression coefficients to the coefficient of determination (r^2). The r^2 coefficient represents the percentage of the full variance in the dependent, endogenous variable that is attributable to each path. In an orthogonal (factors uncorrelated) solution, this can be calculated by squaring each of the direct effect path coefficients and adding them all together. However, because factors are covaried and this model is not orthogonal, one must rely on the squared multiple correlations output provided by AMOS 20.0 (see Table 4.15). It should be noted that the total variance explained in this model is .161.

Table 4.15

Squared Multiple Correlations

Effect	Estimate	Effect	Estimate
Soc_Capital	0.000	Q20_4_Imp	0.014
CC_Adv	0.602	Q38_6_Imp	0.490
College_MS_Prep	0.008	Q38_2_Imp	0.648
Fin_Aid	0.078	Q38_1_Imp	0.611
Par_Inv_HS	0.026	Q25_4_Imp	0.440
DV_Imp	0.161	Q25_5_Imp	0.407
Q32_6_Imp	0.674	Q25_9_Imp	0.565
Q32_3_Imp	0.483	Q25_8_Imp	0.575
Q32_7_Imp	0.875	Q25_10_Imp	0.553
Q20_5_Imp	0.086		

Summary

This chapter presented the demographic characteristics of the target population by conducting a descriptive and comparative analysis. Overall over 70% of the survey sample was female and the average age was 29 years. Ethnicity was over 14% non-White, a statistic that closely mirrors the overall Iowa community college population. It was found that gender, enrollment status, parent education status, and ethnicity were significant predictors of students transferring into STEM programs. Through discriminant analysis, it also was determined that quantitative variables related to the number of college math and science courses taken, financial aid received, and number of dependents were predictors of group membership in the categories of transfer intentions but number of hours worked was not.

The results of the CFA and subsequent SEMs were reported. Significant findings from the study included a strong direct effect on the endogenous variable from social capital, with smaller effects from financial aid received, financial concerns and debt aversion, work-study participation, and college math and science preparation. Other mediating effects were

found with family encouragement, work–study, and parent education. There was not a significant direct effect on the dependent variable through parent education as expected, nor were there any direct linkages from the financial variables to social capital except for a small indirect effect from parent education to financial aid. Parent income, which hypothetically could have created more of a linkage between the two sets of variables, was not tested due to high levels of missing data.

The following chapter presents the interpretation of these findings, discusses the limitations of the study, and offers recommendations for policy, practice, and future research.

CHAPTER 5. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Introduction

For the past decade, the decreasing numbers of graduates in STEM fields has become an increasing concern as America's competitiveness has been eroding in the global economy. Not only has the United States continued to fall farther behind other countries in general degree attainment (Burdman, 2005), but it also has not measured up to other countries in terms of the number of students graduating in STEM fields (Rising Above the Gathering Storm Committee, 2007).

This is especially true of Iowa and other rural areas of this country where many small towns are not regenerating. The best and brightest in these communities are leaving, and little is being done to stop this outmigration. If rural and other socioeconomically challenged regions do not embrace these challenges, they likely will not survive. Access to postsecondary education is one critical aspect of reversing this trend—and by better educating its citizenry, particularly in STEM fields where much growth is predicted, communities can begin to recruit new industry to help them grow and create jobs for this new economy.

Many of the students staying in these communities are first-generation college students; additionally, this includes a growing number of underrepresented minorities. Even in Iowa, which was once considered a very homogeneous state, the student K–12 population now has an 18.5% minority population (Iowa Department of Education, 2011a). For many students in these communities, the only access to higher education may be through their local community college. Given this, it would be advantageous to pay more attention to the role of community colleges to facilitate the increased representation of students in STEM fields.

More often than not, the students in this population lack the social capital and finances to adequately navigate and succeed in the postsecondary arena; yet many quantitative studies have not researched this phenomenon, especially among community college students. The purpose of this study was to examine the influence of social capital and finances on the transfer intentions of community college students into STEM fields. Specifically, the focus of this study was to investigate to what extent students' background characteristics, social/cultural capital, and financial factors, including financial aid received, financial concerns and environmental pull factors related to a student's ability to balance work, home and school responsibilities, impacted a student's transfer intentions into a STEM field.

Based on a review of the related literature, a hypothetical model was proposed integrating the more traditional predictors of student success, including social and academic integration, goal commitment and institutional fit, with the social capital and financial factors more closely aligned with today's community college student. Using the SSSL project survey results from Iowa's 15 community colleges, this study provided the ability to apply theoretical model testing, using SEM as its statistical analysis technique, to look specifically at the social/cultural capital, financial, and environmental pull factors within the original hypothesized model.

This chapter provides a discussion of the findings of the SEM as well as descriptive and comparative statistics related to students' demographic characteristics that address this study's research questions. In addition, recommendations for policy and practice are presented, as are suggestions for possible future research.

Findings

Descriptive and Comparative Statistics

The first three research questions were related to the demographic characteristics of the students in the study and the significance of those characteristics in predicting the dependent variable, intent to transfer in a STEM field:

1. What are the background and demographic characteristics of the students who participated in the SSSL study?
2. Are there statistically significant differences between demographic variables, such as age, gender, enrollment status, ethnicity, and number of math and science courses taken, between the students who do not intend to transfer and those who intend to transfer into a non-STEM field and those who intend to transfer into a STEM field?
3. Are there statistically significant differences between financial variables, such as number of hours worked, number of dependents supported, and amount of financial aid received, between the students who do not intend to transfer and those who intend to transfer into a non-STEM field and those who intend to transfer into a STEM field?

A summary of background and demographic characteristics of the students who participated in the study was provided in response to research question 1. Although a number of characteristics were examined, several items are particularly noteworthy. The variables of gender, race/ethnicity, parental education levels, financial loans, number of

hours worked, number of dependents supported and number of math and science courses taken each will be scrutinized below for their impact on the study's results.

Gender/Age. The gender of students who participated in the study was not evenly divided: 27.3% (n = 1278) was male and 72.7% (n = 3,404) was female. This does not reflect Iowa community college postsecondary enrollment, which is 55% female and 45% male (Iowa Department of Education, 2011a). In addition, the age breakdown also is not representative of the entire population. The average age of this sample was 29 years and the average age of the population being studied is 23 years of age (Iowa Department of Education, 2011a).

This imbalance toward older females is not surprising. Among education survey research it is not uncommon to see more women than men complete surveys. Similarly, it also is common for older students to complete surveys more readily than do younger students. For comparative purposes, the missing data were removed using listwise deletion.

Using a Pearson chi-square test, gender was shown to be significantly different when comparing those with no intentions to transfer to those who intended to transfer into non-STEM fields and those who intended to transfer into STEM fields. Significantly more men were in the latter category than were women. This finding is congruent with the literature (Laanan, 2003; Starobin et al., 2010).

Race/ethnicity. The majority of survey respondents who responded to this question (86.1%, n =4037) were White, whereas 13.8% (n = 461) reported being a minority or of two or more races. The Iowa Department of Education (2011a) reported that, in the Iowa community college population as a whole, 16% are of a minority race/ethnicity. Thus, this finding is fairly representative of the population as a whole. Similar to age and gender, this

variable was missing a significant number of cases and was not imputed. Therefore, this variable could not be studied in the structural equation model.

Using a Pearson chi-square test and removing the missing records through listwise deletion, however, it was noted that there were significant differences in race among the students who intended to transfer and those who did not. The analysis indicated that ethnicities were not represented proportionately in each category of transfer. Looking again at the descriptive statistics, Asians represented 1.8% of the survey sample, but represented 3.6% of the STEM transfer population. Likewise, Whites represented 78.5% of the sample but 82.1% of the STEM population and African-Americans represented 3.7% of the sample but 5.4% of the STEM transfer population. Whites and Asians have been found in the literature to be overrepresented in STEM fields as compared to Hispanic and Blacks. The fact that Blacks are overrepresented in this sample differs from the findings reflected in most previous literature. This could be due to a number of reasons and would require further study beyond the scope of this study. For example, it is possible that the African-Americans responding to this survey were highly concentrated in just one or a small number of colleges; and perhaps, these findings are the result of specific efforts within those institutions that would directly affect the retention and support given to these minority students.

Parental education. Another demographic characteristic worth considering is the level of parental education, which ranged from those who did not complete high school to those with graduate degrees. Upon review of the demographic characteristics, it is evident that those with parents having lower levels of education were more represented in nontransfer and transfer non-STEM categories than were students who had parents with higher levels of education. This result is congruent with findings from previous research.

Further results described below illustrate the direct and indirect effects of parental education on the endogenous variable.

Number of hours worked. Due to previously reported research on this subject, it was hypothesized that the more hours a student worked, the less likely she or he was to transfer. Although 40% of students worked 21 or more hours per week, this did not significantly influence transfer intentions according to the results of the discriminant analysis test or the structural equation modeling analysis. The only work-related factor that did influence intent to transfer was holding a work–study position on campus. This was also highly correlated to access to institutional agents, which also directly affected intent to transfer. This is congruent with the literature and will be explored more in the next section.

Number of dependents supported. Nearly 50% of the individuals in the sample were supporting dependents. Approximately 29% was supporting one or two dependents, 16% was supporting three or four dependents, and 5% was supporting five or more dependents. Looking at the raw data, it appears that students supporting no dependents were overrepresented in the intention to transfer into STEM fields group (49.6% in the total overall sample compared to 53.3% in the STEM transfer group). However, the same can be said for students financially supporting five or more people (5.3% in the total overall sample versus 7.1% in the STEM transfer group). This did prove to be a significant indicator in the discriminant analysis but did not provide for good model fit in the final structural model, which is discussed in more detail later in this chapter.

Financial aid. Financially speaking, 30.9% of the sample had no loans, and the remainder of the students had an average of nearly $4,000 in loans. In fact, over 22% of the students had over $6,000 in loans for the first year, and half of those had over $10,000 in aid

that needed to be repaid. This is not surprising in Iowa, which has high community college tuition rates compared to those in other states. According to the Iowa College Aid Commission (2010), associate's degree recipients graduating from Iowa's community colleges had an average debt of $12,711.

Similarly, about 28% of the students had no scholarships or grants, whereas the remaining students had an average of nearly $2,000 in aid that didn't need to be repaid. Using discriminant analysis, it was determined that this was a significant predictor of STEM transfer. This variable, along with aid that did not need to be repaid and work–study, were studied further in the structural model and will be discussed further below.

Number of math and science courses taken. This is not a perfect measure because it was not known how long each student had been enrolled at the community college or whether he or she had transferred in prior college credits. We did, however, ask participating colleges to exclude students who were in their first semester of attendance. Past studies have used GPA as a predictor; however, this was not available in this study. Another shortcoming of this particular variable is that the survey instrument did not give students the option of selecting "I have not taken any math or science courses"; thus, it is impossible to discriminate between those who just skipped the question and those who had not taken any math or science courses. Therefore, there were no missing variables for this question. Those who didn't answer the question were given a "0."

The survey instrument listed a variety of types of math and science courses and asked participants to check which ones they had taken at the college level. The responses ranged from 0–15. Of the total sample, 60% had taken 0–2 courses, 35% had taken 3–6 courses, 4% had taken 7–9 courses, and 1% had taken 10 or more courses in these fields. Those in the

first category, 0–2 courses, would account for most students who had taken the required math and science courses as part of a general education curriculum.

The discriminant analysis did indicate statistical significance for this variable as a predictor of student transfer intentions. Those students intending to transfer into a STEM field were more likely to have taken more college math and science courses. This variable is also included in the structural model and will be discussed in more detail below.

Inferential Statistics

Questions 4 and 5 were related to the factors most often associated in the literature with social capital and finances. This study used CFA and SEM to further analyze these factors and their direct and indirect effects on the endogenous variable.

4. How do factors related to social/cultural capital (i.e., debt aversion, parental involvement, parent education levels, family encouragement and access to institutional agents) influence community college students' intention to transfer to a 4-year institution in a STEM field after graduation?
5. How do factors related to the students' ability to finance their education as well as environmental pull factors and financial concerns related to enrollment and employment status and support of dependents influence community college students' intention to transfer to a 4-year institution in a STEM field?

Social/cultural capital. Eleven different observed variables where shown to have a direct or indirect effect on the social capital construct. Using CFA, a second-order construct was identified, consisting of variables from parent involvement in high school as well as access to community college advising in regards to the transfer process. Three other

observed variables, including family encouragement, work–study, and parent education, had an indirect effect on the dependent variable through social capital.

Five variables related to parent involvement in high school were found to be significant predictors of social capital, including: (a) Question 25-8: Spend time just talking with you (.76 loading); (b) Question 25-9: Work with you on your homework (.75 loading); (c) Question 25-10: Discuss your progress in school (.74 loading); (d) Question 25-4: Participate in school-related activities (e.g., Parent-Teacher Association) (.66 loading); and (e) Question 25-5: Spend time talking with your friends (.64 loading). Two other variables, "discussing books, film or television programs with you" and "eating the main meal around the table with you," proved to have a more marginal fit and were eventually taken out of the model to increase parsimony.

Parent education level was defined as having one or both parents with a bachelor's degree. This variable was shown to have a direct effect on parent involvement in high school, but its effect on the dependent variable was weak and therefore it was dropped from the model. This is contrary to previous research, which has indicated larger effects of parent education on student transfer and success (Pascarella et al., 2003, Yazedjian et al., 2009). In addition, student's mother's education has proven to be more indicative of student success in some studies than has father's education (Paulsen & St. John, 2002). Although this may be due more in part to the study design than to actual differences, this theory was tested using this data due to the high number of females in this study. To accomplish this, mother's education was substituted for the combined parent education variable, and the chi-square increased substantially and model fit statistics decreased; therefore, it was not considered a good fit with the data. As a result, in this model parent education is only marginally

significant and only as a mediating variable through parent involvement. The direct effect of parent education on the intent to transfer into a STEM field was not significant.

In addition to parent involvement in high school, the other construct that makes up social capital is community college advising. This is representative of three variables: (a) Question 38-2: Information received from academic advisors/counselors was helpful in the academic process (.82 loading); (b) Question 38-1: I consulted with academic advisors/counselors regarding transfer (.80 loading); and (c) Question 38-6: Academic advisors/counselors identified courses needed to meet the general education/major requirements of a 4-year college or university I was interested in attending (.69 loading). Questions 38-4 and 38-6 were removed from the construct due to marginal significance at .59 and .56, respectively. Once those variables were removed, the chi-square value decreased significantly and model statistics improved. In total, the standardized regression coefficient from social capital to the dependent variable, intent to transfer in a STEM field, was .33. This construct is related to a student's ability to access institutional agents who can help them with the transfer process. This is a critical aspect of social capital, as it accounts for 78% of the variance explained. When a student does not have access to information or resources or to parents who have the wherewithal to help them navigate the process, they may fall through the cracks. This is when access to pertinent information and assistance becomes even more important.

Related to this construct is a student's participation in the college's work-study program. In previous studies, work-study has been shown to be a positive indicator of student success (St. John, 1990; Whalen & Shelley, 2010). In this study, the variable had a small but significant direct effect on the dependent variable, but it also was a mediating

variable to community college advising (.06). This means that those students who participated in the work–study program were more likely to be engaged with community college advisors than were students who were not.

One other related finding is the indirect effect (.09) of community college advising on intention to transfer into a STEM field through the mediating variable of college math and science courses taken. This means that students who have taken more college-level math and science courses have had more interactions and assistance with advisors on campus and this has indirectly affected their intentions to transfer into a STEM field.

It should be noted here that cultural capital, as originally defined as parent education and debt aversion, was not significant in this study. Neither parent education nor debt aversion had a significant direct effect on the dependent variable. As mentioned above, parental education directly affected part of the social capital construct. Similarly, it also indirectly affected the financial aid construct, which is mentioned below. The two related questions to debt aversion were Question 32_3, which asked how likely "Debt—need to work more hours to pay bills" would prevent students from obtaining their college degree, and Question 26_1, which asked students how thrifty they were in comparison to their parents. Question 26_1 did not prove to be important to any part of the model; however, Question 32_3 was part of the final model related to financial concerns. This will be addressed below.

Finances. Three first-order constructs were initially identified as part of the financial-related variables in this study: financial aid received (loans, scholarships and grants, family resources, and debt aversion), financial concerns (concerns about ability to finance their education and attitudes about debt), and environmental pull factors (number of hours

worked; number of dependents supported; and the ability to balance work, home, and school responsibilities). It should be noted here that parent income initially was part of the hypothetical model as it has been consistently shown in the literature to be associated with higher levels of persistence (Novak & McKinney, 2011; St. John, 1990). However, analysis of the missing data for this particular question was troublesome, as over 30% of the respondents did not answer this question. Due to the high level of unreliability for this question, it was removed from the model. Rather than asking for specific income levels, future versions of this survey may ask more generally a question about their family's financial well-being. Although this is more subjective in nature, many students do not know their parent incomes or are uncomfortable wagering a guess. All three constructs were tested in the causal structure after confirming their validity in the CFA.

Environmental pull factors. Although the environmental pull factors construct was directly correlated to the other two constructs related to financial aid and financial concerns, it had very little bearing on the dependent variable, as the *p*-value showed no significance. Once removed from the model, the model fit statistics improved greatly.

This is contrary to previous research, which stated that finances related to the number of hours worked (Astin, 1993; King, 1999; Miller et al., 2008; Moreno, 1998), number of dependents supported, and the student's ability to manage work, home, and school (Santiago, 2007; Zarate & Pachon, 2006) influences a student's ability to persist.

It was reported earlier that Iowa children under 6 years of age have a higher percentage of all parents working outside the home than anywhere else in the country (French et al., 2011). Although this may seem in direct contradiction to these findings, this study has a much larger percentage of older adults as well as a much larger representation of

females than does the community college population as a whole. This finding may be a reflection of that statistic. In this study, about 48% of the sample reported financially supporting one or more people, 25% were married, and 25% were working more than 30 hours a week. If both adults in the household are working, that may remove some stress from the individual in higher education and the inability to manage work, home, and school responsibilities may be less apparent.

Financial aid. The financial aid construct in the final model is made up of the amount of educational expenses that are contributed by (a) aid that does not need to be repaid (grants, scholarships, military funding, etc.) and (b) aid that does need to be repaid (loans, etc.). This response was provided on a dollar value scale ranging from none to $10,000+. Other items in this scale, including employer contributions and other sources, were removed from the analysis as the responses were not normally distributed. In addition, family resources was removed from the final model in the last stage of analysis and model fit numbers improved.

The original model from the CFA included one of the variables that measured debt aversion. Although it initially loaded high on the EFA, subsequent analysis through SEM showed that it wasn't a significant factor within the financial aid construct. This question measured students' thriftiness compared to their parents and was initially hypothesized within the social capital construct. This is supported in the literature, which recently has reported findings that some students, particularly Hispanics and African-Americans, have demonstrated an unwillingness to take out loans to get their education and that this attitude has been inherited from their parents (Burdman, 2005; Callender & Jackson, 2005; Chen & DesJardins, 2008; Gladieux & Perna, 2005; J. Kim et al., 2009). To further test whether this

variable should remain in the model as an observed variable, additional tests were conducted and it was found that that portion of the model just simply did not fit this sample data. One reason for this may be because it isn't a very good measure of debt aversion or it may be that there were not enough Black and Hispanics in the study to adequately test this theory, especially as it relates to cultural capital. However, another question in the study presented in the financial concerns construct is also related to debt aversion and may serve as a better indicator of this phenomenon among this rural, disadvantaged population.

Other relationships in this model affecting financial aid included a covariance with the financial concerns construct and a direct effect from parent education. This indicated that parent education affects the dependent variable indirectly through its effect on financial aid. Not surprising, this means that higher parent education levels typically result in lower levels of financial aid received.

One significant finding of this study is the fact that financial aid (loans and scholarships/grants) negatively affected the dependent variable. When financial aid goes up, a student's intention to transfer to a 4-year institution in a STEM field actually goes down. Although the previous research on this subject is mixed, it is contrary to much of the research, which states that financial aid has a positive effect on persistence. This may have to do with the fact that this investigation separated work-study from other forms of aid, unlike Cabrera and colleagues' (1992, 1993) studies. This is supported by more recent research that has shown that work-study is more productive and cost-effective than grants or loans (Wohlgemuth, Whalen, Sullivan, Nading, Shelley, &Wang, 2006).

This finding is also likely related to the changing demographics of the students in higher education and the fact that tuition and fees are drastically outpacing Pell grants and

other need-based aid. If family income and available need-based aid cannot keep up with the skyrocketing cost of education, then lower income students have been effectively priced out of the market and it will soon become a luxury that only affluent students can afford.

Financial concerns. The financial concerns construct was recommended in the literature as the subjective component of finances, reflecting students' perceptions of their difficulty to finance college-related expenses (Cabrera et al., 1993). This was measured in this study by three variables related to issues that might prevent students from obtaining a college degree, including: (a) debt—need to work more hours because of bills; (b) insufficient financial aid; and (c) lack of money. The first variable measures debt aversion, or a student's lack of desire or ability to take on additional debt to pay for school. As reported previously, many students are forgoing education because of their need to work to pay their bills. It has been theorized that their unwillingness to take on debt to ease the financial burdens short term and allow them to work fewer hours is hindering their ability to get an education. The standardized regression coefficient from financial concerns to the dependent variable, intent to transfer in a STEM field is shown as .10. This differs from Cabrera et al.'s (1992, 1993) model in which financial attitudes was found to have only an indirect effect on intention to persist through academic integration. This may have been due to the inclusion of the question about debt in the current study, which differs from Cabrera et al.'s (1992, 1993) past research. It may also have to do with the fact that the current studied a much more diverse student population than was previously studied.

Number of math and science courses. This was a measure of academic preparation for transfer into STEM programs at a 4-year institution. In the final structural model, this variable is both an endogenous variable and an exogenous variable. A significant path is

shown from community college advising to college math and science preparation. This standardized regression coefficient is shown as .09. The path from college math and science preparation to the dependent variable also is significant. This standardized regression coefficient is shown as .12.

The survey tool also asked respondents to indicate how many high school math and science courses they had taken. These two variables were tested several different ways within the model to determine which one or a combination of the two best helped explain intent to transfer in a STEM field. Number of college math and science courses taken was the best indicator, better than number of high school math and science courses taken and a combined variable of overall math and science courses taken.

Although college-level math and science courses taken was best used as the predictor variable in this study, it should be noted that this may not hold true for other studies. In this case, the study took a model development approach versus a strictly confirmatory approach. As Garson (2012) noted, much of the SEM research commonly combines confirmatory and exploratory purposes using modification indices to identify new relationships among variables. The problem with this approach is that models confirmed in this manner are posthoc ones that may not be stable (may not fit new data, having been created based on the uniqueness of an initial dataset).

Conclusions

The following conclusions were drawn from the findings of this study:

1. There are statistically significant differences in gender, ethnicity, and enrollment status in predicting transfer intentions of students going into STEM fields. These finding are supported by previous literature. The difference between parent

education levels, however, was only significant as a mediating variable; it did not directly affect transfer intentions as previous studies have shown. This may be due to the fact that the dependent variable was transfer intention rather than actual transfer behavior. This is a limitation that could affect this result in particular. Students might have the best intentions to transfer but, due to social capital, financial issues, or other reasons, may not be able to successfully navigate the system. What this indicates is that the difference of parent education levels between students who intend to transfer into STEM fields versus those who don't is only marginally significant. Conducting this as a longitudinal study may bear different results.

2. Parent involvement in high school is a significant predictor of transfer predictions. This finding is consistent with findings from other studies; however, the strength of the association may not be as strong given that it predicts only .026 of the explained variance of social capital. In addition, parent education levels are a predictor of parent involvement in high schools. The more educated the parent, the more likely he or she is to be involved in school-related activities, help students with their homework, and discuss students' progress in school. Covaried to this construct is the observed variable of family encouragement.
3. Family encouragement is related to parent involvement in high school and has a mediating effect (although no direct effect) on transfer intentions through access to institutional agents such as community college advisors. This suggests that family encouragement and support assists students in finding the right information and support on campus to help them be successful.

4. In this study's model, community college advising has the most significant effect on transfer than any other variable studied. It accounts for nearly 60% of the variance explained through social capital. This speaks to the importance of providing students with the appropriate resources and knowledge of what they need to do to adequately prepare for the transfer process. This is extremely important in community college settings due to the large number of first-generation college students who may not otherwise have the knowhow or resources to obtain the knowledge they need to be successful.
5. Work–study positions on campus previously have been found to be a positive predictor of student persistence, even when other work off campus has been a negative predictor. This was upheld by the data from this study. This variable proved to have a small, but direct, effect on transfer intentions as well as an additional indirect effect through access to institutional agents. Students working on campus were much more likely to have transfer intentions in STEM fields than those who were not. There may be a few reasons for this phenomenon. First, these students have access to many more institutional agents than they might otherwise have due to their regular interactions through their work-study position. These agents are likely to take a special interest in the student and/or the student has more know-how about where to go for help.
6. There was no statistical significance comparing the environmental pull factors of those students who were not transferring with those who were. This is in contrast to previous findings in the literature. This may be related to the large overrepresented sample of nontraditional students in the study. With over 70%

nontraditional females at an average age of 29, this sample looks much different than the Iowa community college population as a whole as well as from a nationwide perspective. It may also have to do with the fact that Iowa ranks first in the nation in the percentage of children under 6 years of age with all parents in the labor force (75.6%; French et al., 2011).

7. The impact of financial aid on transfer intentions is a small, but significant, negative effect. The more financial aid students receive, the less they are likely to have plans to transfer. The size of the effect might increase if one were to examine actual transfer patterns rather than intent to transfer. Students in their first year may not fully understand the full ramifications related to their ability to finance their education. The pressures of financing another two years of education may not come until later, when a student better understands just how expensive it is. As expected, parent education directly affects intent to transfer as a mediating variable through financial aid. Because the negative effect is in contrast to much of the past research from previous decades, this should be given some additional attention in the future as college costs continue to escalate.
8. Financial concerns and debt aversion are both significant predictors of transfer intentions. Students with concerns of insufficient financial aid and an aversion to debt are less likely to have transfer intentions. Recent studies have supported this and suggested that those students with the highest levels of financial concerns and an aversion to debt are Hispanics and African-Americans. Given the small number of underrepresented minorities in this study, this would be an area for future research and follow up.

9. College math and science preparation is a significant predictor of transfer intentions and is a better predictor than is high school math and science preparation or a combination of the two. Past studies have used college GPA as a predictor of student persistence. Due to the exempt nature of this study and its status with the IRB office at Iowa State University, collection and interpretation of this data were not possible. However, it is hypothesized that the number of math and science courses taken is a fairly reasonable proxy measure of GPA, given the intellectually demanding nature of the courses and the fact that, due to recoding, a student who had taken one or two math and science courses was categorized the same as a student who had taken no courses. The assumption was made that a student who had taken only one or two courses may just have been taking a basic course to fulfill the general education requirement of an associate's degree. Future versions of this study may want to incorporate college GPA into the instrument or obtain the information directly from the participating colleges.

Recommendations for Policy and Practice

Several recommendations were developed from this study's findings, conclusions, and limitations pertaining to policy implications as well as improvements and innovations in practice.

According to the *Iowa STEM Education Roadmap* (Iowa Math Science Education Partnership, 2011), to dramatically increase the number of students in the STEM pipeline, there must be a focus on programs that concentrate efforts on getting more females, minorities, and low-income students interested in those fields. By scaling up and replicating successful partnerships with K–12 districts, business and industry, and community colleges,

students can become engaged in STEM curriculum earlier in their secondary education. Involving the business community can ensure timely and relevant curriculum and information about careers in the classrooms and provide positive role models for students.

Community college programs represent one of the best ways to reach disadvantaged students, as they disproportionately attend these colleges over other types of institutions. Lawmakers can help this by more adequately funding this nation's 2-year institutions and the students who attend them.

Practice

Community colleges, 4-year public universities, and business/industry should work together to develop innovative STEM programs. These programs should replicate best practices such as mentoring, learning communities, early academic interventions, scholarships, science fairs, and role model programs that will be helpful in the recruitment and retention of students in STEM fields.

One-one-one assistance to students in areas such as tutoring and financial and computer literacy will be a critical strategy. One such model for consideration is Washington state's Integrated Basic Education and Skills Training program (also known as the I-BEST model), where basic skills are being taught alongside technical skills and students are asked to apply those basic skills in the context in which they will be used (Tinto, 2012, p. 42). Other strategies include learning communities, workshops, and summer camps with middle school students and career academies, such as Project Lead the Way, for high school students. Businesses interested in a qualified STEM workforce could sponsor students, helping cover the cost of their education in exchange for internships during summers and breaks as well as employment after graduation. They could also assist in the funding of

costly equipment and technology. The more closely tied business and industry is to the college's programs and curriculum, the more likely it is to remain relevant and up-to-date and students are able to see and understand the program's connection to the workforce. In addition, focused articulation and transfer agreements as well as common course numbering would ensure that more coursework is accepted for transfer from community college to the 4-year institution. Removing some of these key roadblocks are critical for all students, but even more so for the most at-risk students.

A case for an extended orientation or a freshman seminar course also has been made in the literature (Pascarella & Terenzini, 2005; Zeidenberg, Jenkins, & Calcagno, 2007). All new students, for example, are required to take a 1.5 credit course at Community College of Baltimore County to develop an academic plan as well as help them access student support services, including advising, financial aid, and tutoring, and gain effective strategies from studying to coping with work–life–school balance issues. Some course sections are reserved for students who are part of a learning community, whereas others are specifically reserved for minority students (Tinto, 2012). This helps provide the necessary access to institutional agents that proved a critical predictor of students' intention to transfer in this study.

Extended advising and career counseling also may be helpful as part of this model. There seems to be a disconnect between some students and their understanding of the requirements and qualifications necessary to complete higher degrees. In addition, many students might not understand the importance and value of critical career/technical areas in which they may excel. Manufacturing, for example, might offer tremendous opportunities for students interested in STEM technician fields. Findings from the current study support this recommendation, which identified the link between community college advising and the

number of college math and science taken and which directly affected the transfer intentions of students in STEM fields.

Unfortunately, these more extensive advising models require additional staffing and are costly to implement. For those colleges who cannot afford such a program, they may consider the benefits of peer advising. Through the use of student counselors, tutors, and advisors, many colleges can implement some of these strategies at a lower cost and make inroads to better serving their students. Although they cannot take the place of professional staff, well-trained peer advisors can direct students where to go to access various services and get specific information and they can help identify students who need additional institutional resources and assistance (Tinto, 2012).

It is not surprising that the direct effect of financial support on retention is most apparent on low-income, financially dependent students when unexpected needs arise (Gross, Hossler, & Ziskin, 2007; McGrath & Braunstein, 1997). Thus, financial support that is made available as emergency needs arise, rather than just at the beginning of the term when financial aid is dispersed, may also be helpful. Many donors and private philanthropists who like to support student financial needs through scholarships may be just as motivated to provide support to needy students through an emergency crisis support fund.

Policy

This research was meant to not only assist practitioners in developing initiatives to help these at-risk populations succeed in STEM fields, but also to be used as a tool for influencing policymakers and granting organizations. If community colleges are to help these students, they need additional funds to do so. Funding some pilot projects that test innovative ideas on a small scale might be beneficial. Many states, such as California, New

Jersey, and New York, are funding programs similar in nature to the federal TRiO programs, which allow colleges to package a variety of student support services together (Tinto, 2012, p. 50). At the federal level, this would likely mean in infusion of additional funds to community colleges, which already receive far less per student than do their 4-year counterparts. The Center for American Progress (Pusser & Levin, 2009) recently suggested the need to rethink the degree of support provided to community colleges, challenging the United States to meet the level of financial support provided in countries that are outdistancing it in the education race.

Perhaps even more importantly, lawmakers at the state and federal level need to consider ways to financially help disadvantaged students. The Center for American Progress also called for an additional federal financial support program modeled after the "Post 9/11 G.I. Bill" that would include student stipends for full-time or part-time community college attendance and allowances for books and supplies (Pusser & Levin, 2009).

At the state level, this could include a generous increase in need-based aid. This is supported by recent research that found that an increase in state need-based grants raised the odds of enrollment in 2-year colleges and private competitive colleges (J. Kim, 2012). For example, if Iowa is serious about increasing the number of low-income students in STEM programs, it should consider a need-based grant program for students who enroll in very specific programs named within STEM. This could be administered by the Iowa College Aid Commission. To qualify as a STEM program meeting high needs in the state, the college would need to apply and its program(s) would need to be selected. In exchange for receiving the grant, a student must work in the field in the state of Iowa for a specified number of years. If that condition is not met or if the student does not graduate, the grant would be

converted to a Federal Direct Unsubsidized Stafford Loan and it would be repaid to the state. Similarly, tuition forgiveness could be given to students who work in STEM fields in Iowa after graduation.

Another way of helping students financially is through federal and state work-study programs. Consistent with findings from this study, many times work–study has been found to support student success and retention (Astin, 1993; Pascarella & Terenzini, 2005; Whalen & Shelley, 2010), especially when constructed with other student retention activities (Tinto, 2012) and directly related to a student's field of study (Broughton & Otto, 1999). When comparing the cost-effectiveness of the government's investment in financial aid versus work-study funding, Wohlgemuth et al. (2006) findings suggest that work-study is a better way to invest in student success. U.S. Department of Education Under Secretary, Dr. Martha Kanter (2013), suggested that, although work-study is most typically used to provide students with on-campus employment, institutions and states might find creative ways to leverage federal work-study funding by using it as an incentive for business and industry to match the program with additional funds so they can offer paid internships to students. In addition, states might also offer tax credits to those businesses that offer these opportunities.

Finally, several researchers (Immerwahr, 2003; McDonough & Calderone, 2006; Perna, 2004; St. John, 2006) asserted that a main causal factor for the low number of minority and low-income students in college is a lack of knowledge about college costs and a perceived lack of financial aid availability. In fact, King (2004) found in 1999–2000 that approximately 850,000 students who were likely to be eligible for a Pell grant did not apply for federal financial aid at all. This suggests that students and their parents could benefit from college financial planning seminars earlier in their secondary education (beginning in

middle school). State funding through the Iowa College Aid Commission or other non-profits, such as the Iowa College Access Network, could help pay for such initiatives.

Ultimately, it is important that students and their parents understand the net price—the published price minus the grant aid, scholarships, loans, tax credits, and deductions—that students actually pay. These initiatives also could be an avenue to help explain the various types of aid and how to access them. Other strategies actually call for streamlining the processes related to applying for aid and taking advantage of duplicative information collected elsewhere. One innovative pilot program tested in Ohio and North Carolina in 2008 and 2009, for example, actually helped low and moderate income families submit their FAFSA through local H&R Block tax preparers. Using information already supplied on tax forms, H&R Block tax professionals were able to help qualifying families submit the FAFSA in 10 minutes, a process that the IRS conservatively estimates takes families 13 hours to complete on their own (Bettinger, Long, & Oreopoulos, n.d.).

Without interventions such as these, many students (and their parents) will continue to have "sticker shock" about the cost of education and be confused about their ability to qualify for aid. This could lead to premature decisions about attending (or not attending) college and lead to poor decisionmaking regarding whether or not to take college preparatory classes. In addition, educating students about the long-term financial effects of not getting a college education could also counter-balance some students' reluctance to take on debt, which researchers say is another reason for lack of higher education, especially among minority students (Burdman, 2005; Callender & Jackson, 2005; Chen & DesJardins, 2008; Gladieux & Perna, 2005; J. Kim et al., 2009; Malcom & Dowd, 2012; Trent et al., 2006).

Recommendations for Future Research

This research attempted to shed some light on social capital and financial issues related to community college students' intentions to transfer into STEM fields. This study was conducted on 15 mostly rural community college campuses within the state of Iowa and is, therefore, not generalizable to most populations outside of the state. Additional exploration should be conducted with a more diverse sample to correct limitations with this study in regards to race/ethnicity and gender. A more diverse sample in both rural and nonrural locations might also allow for additional data mining and comparison between groups.

As mentioned previously, a huge limitation of this study is the fact that it was based on students' intentions to transfer in contrast to their actual transfer outcomes. Many students may have the desire to transfer but, because of social capital and/or financial factors as well as other variables, may be unable to do so. A longitudinal study studying actual student transfer patterns over time may produce different results. In addition, all of the data were self-reported. In the future, some pieces of data could be overlaid with institutional data (i.e., GPA, financial aid, number of math and science courses taken) to not only simplify the survey for students but also to allow for more accuracy and less missing data. Similarly, data from the National Student Clearinghouse (n.d.) also may provide a wealth of information for use for a national study. Additionally, the question related to parental income needs to be restated or needs to be collected in a different way to address the large percentage of missing data in this study.

In terms of future studies, researchers need to drill deeper into better understanding what STEM initiatives and student persistence activities are really making a difference. As

more public education dollars are being cut both at the federal and state level, there will continue to be a shift toward higher levels of assessment and accountability. As President Obama's national completion agenda, college scorecard, and other recent initiatives have suggested, institutions must be willing to take a critical look at themselves and identify both what is working as well as what is not and make changes accordingly. This will have two effects: (a) it can curb rising tuition by removing programs that are not working and (b) it can reallocate existing dollars to programs with more of an impact. Academic research and the use of tools such as SSSL can assist institutions in that process. Then these best practices can to be shared and utilized across the nation for others to replicate.

Additionally, there needs to be more research to better understand the unique characteristics of today's diverse community college student. More research is needed to expand on the notion of debt aversion, especially among minority students. This is an area of research that has emerged within the last few years, and it really needs attention, especially in light of the rapid increase in tuition and fees, the continued looming threat of Pell grant cuts, and the dwindling support of state and need-based aid. Have many people been priced out of higher education? At what point do students no longer see the "return on investment" for higher education?

A deeper examination of how financial and social and cultural capital attributes related to community college students fit within Cabrera et al.'s (1992, 1993) integrated model of student retention should continue. This study examined only a portion of the hypothesized model that was suggested in Chapter 3. It would be interesting to conduct a study on the entire model to determine what other indirect and direct effects financial and social and cultural capital had on the other elements of academic integration, social

integration, goal commitment, institutional commitment and fit, and other academic performance indicators. Given the comprehensiveness of the SSSL survey instrument and the specific information it provides, it could be very useful to analyze a model such as that. Because very little research has been done specifically regarding STEM students in community colleges, this research could be especially noteworthy. Finally, involving a mixed methods study that incorporates a qualitative aspect could provide rich context in helping to understand a very complex problem.

Conclusion

Educational leaders, policymakers, the business community, and others are grappling with the challenges currently facing the nation, particularly those surrounding workforce issues and trends and global competition in the marketplace. At the center of this complex issue is the need to focus on the education and training that will propel Americans to better compete and regain the United States' status as the world leader in education. In many ways community colleges are the lynchpin to making this happen, and as a result, many have called for a transformation of these institutions.

This transformation should begin, however, with a more complete understanding of the needs and potential of the diverse student body that community colleges serve. The goal of this study was to provide some context to make that happen, particularly in rural-serving areas such as Iowa. By learning more about the unique characteristics of community college students, and particularly those who want to transfer in STEM fields at 4-year institutions, colleges can begin to better adapt practices and policies that will better serve them and ultimately help them succeed.

APPENDIX A. STEM STUDENT SUCCESS LITERACY SURVEY INSTRUMENT, FALL 2012

Default Question Block

Q1.
Dear Student,

On behalf of the research team, our sincere thank you for your time in responding to the following questions.

This survey will take approximately 15 minutes to complete. Your responses will inform research that will guide instructional practice, student services, and academic support programs to maximize student success! Your participation is critical to the project. We thank you for your attention to the questions and for completing of the survey.

Directions for filling out the survey:
- **The survey is divided into four sections. Scroll through each section to answer the questions.**
- **Please complete the entire survey (Plan on approximately 15 minutes).**
- **When reviewing questions, respond to each with what first comes to mind as the appropriate responses.**
- **Please click on NEXT at the bottom of each page to advance to the next page.**
- **If you need to leave the survey temporarily, simply close your web browser. You can come back to complete the survey through the same link within 7 days.**
- **Please click on NEXT at the end of the survey to submit your answers. You will NOT be able to make any changes once you submit.**

Upon completion of the survey, you will be automatically entered in a lottery for a random drawing. If you are selected as one of the winners in the lottery, you will be required to sign a receipt form documenting receipt of the prize. Please know that payments are subject to tax withholding requirements, which may vary depending upon whether you are a legal resident of the U.S. or another country. If required, taxes will be withheld from the prize you receive. You will need to provide your social security number (SSN) and address on a receipt form. This information allows the University to fulfill government-reporting requirements. Confidentiality measures are in place to keep this information secure. You may forgo receipt of the prize and continue in the study if you do not wish to provide your SSN and address.

All answers will become part of a larger data set, and responses are not identifiable to you as a student responder.

Again, we thank you for your time and effort.
Best Regards,
Soko S. Starobin, Ph.D.
Assistant Professor, School of Education
Director, Office of Community College Research and Policy
starobin@iastate.edu

Q2. **Section 1: Self-Efficacy**

The following questions are a series of statements about your personal attitudes and traits. For each item below, please indicate the extent to which you disagree or agree with the statement.

	Disagree strongly	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Agree strongly
If I can't do a job the first time, I keep trying until I can.	O	O	O	O	O	O	O
When I have something unpleasant to do, I stick to it until I finish it.	O	O	O	O	O	O	O
Failure makes me try harder.	O	O	O	O	O	O	O
I often make lists of things to do.	O	O	O	O	O	O	O
I usually mark important dates on my calendar.	O	O	O	O	O	O	O

	Disagree strongly	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Agree strongly
I do not seem capable of dealing with most problems that come up in life.	O	O	O	O	O	O	O
If something looks too complicated, I will not even bother to try it.	O	O	O	O	O	O	O
When trying to learn something new, I soon give up if I am not initially successful.	O	O	O	O	O	O	O
I wish I could have more respect for myself.	O	O	O	O	O	O	O
On the whole, I am satisfied with myself.	O	O	O	O	O	O	O

Q3. **The following questions are a series of statements about your personal attitudes and traits in various social aspects. For each item below, please indicate the extent to which you disagree or agree with the statement.**

	Disagree strongly	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Agree strongly
It is difficult for me to make new friends.	O	O	O	O	O	O	O
If I see someone I would like to meet, I go to that person instead of waiting for him or her to come to me.	O	O	O	O	O	O	O
I do not handle myself well in social gatherings.	O	O	O	O	O	O	O

Q4. **Since you began attending this college, how often do you engage in the following?**

	Never	Rarely	Sometimes	Often	Always
Worrying about what others think of me	○	○	○	○	○
Doing things so that others will like me	○	○	○	○	○
Worrying about being called a "nerd" or "braniac"	○	○	○	○	○
Worrying about being accused of not being myself (e.g."acting white" or being a "sell out")	○	○	○	○	○

Q5. **Compared to the students at your campus, where the average student is at the 50th percent, rate your confidence about your level of skill according to the following scale.**

	I'm in the bottom 10%	I'm below average but not in the bottom 10%	I'm about average	I'm above average but not in the top 10%	I'm in the top 10%	Not applicable
Math skill	○	○	○	○	○	○
Writing skill	○	○	○	○	○	○
Public speaking skill	○	○	○	○	○	○
Social skill	○	○	○	○	○	○
Computer skill	○	○	○	○	○	○

Q6. **Please think about the most challenging class you have taken in this college, and answer the following questions based on your experiences in this class.**

Q7. **What subject does this most challenging class belong to?**

- ○ Biology
- ○ Chemistry
- ○ English
- ○ Mathematics
- ○ Physics
- ○ Other, please specify

Q8. Why was this class the most challenging?

	Strongly Disagree	Disagree	Slightly Disagree	Neither agree nor disagree	Slightly Agree	Agree	Strongly Agree
Did not know how to study for the exams	○	○	○	○	○	○	○
Did not get enough feedback from the professor	○	○	○	○	○	○	○
Professor was not available to answer questions	○	○	○	○	○	○	○
Professor did not encourage interaction with him/her	○	○	○	○	○	○	○
Professor expected a low performance from me	○	○	○	○	○	○	○
The course required a large amount of work	○	○	○	○	○	○	○

Q9. On a scale of zero to ten (0: No Anxiety - 10: Extreme anxiety), what was your level of anxiety in this class?

	0	1	2	3	4	5	6	7	8	9	10
Anxiety (0: No Anxiety - 10: Extreme Anxiety)											

Q10. What negative impact did your anxiety have on your class performance?

- ○ No negative impact
- ○ Small negative impact
- ○ Moderate negative impact
- ○ Significant negative impact
- ○ Extremely significant negative impact

Q11. When you were working at a challenging task in that class, how confident were you that you would succeed?

- ○ Extremely confident
- ○ Very confident
- ○ Confident
- ○ Somewhat confident
- ○ Not at all confident

Q12. **If you succeeded at a challenging part of this class, would you say it was because of:**

	Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree
Your high ability	O	O	O	O	O	O	O
Good luck	O	O	O	O	O	O	O
The task was easy	O	O	O	O	O	O	O
You worked hard	O	O	O	O	O	O	O

Q13. **If you failed (or were less successful) at a challenging part of this class, would you say it was because of:**

	Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree
Your low ability	O	O	O	O	O	O	O
Bad luck	O	O	O	O	O	O	O
The task was hard	O	O	O	O	O	O	O
You didn't work hard enough	O	O	O	O	O	O	O

Q14. **Please indicate the things you did to address the challenges in this class, and how useful they were in improving your performance.**

	Did not use/ not applicable	Used, not helpful	Used, somewhat helpful	Used, very helpful
Spent more time studying	O	O	O	O
Taught myself to study more effectively	O	O	O	O
Did all of the assigned reading	O	O	O	O
Increased lecture attendance	O	O	O	O
Received a sample test from a friend or club/organization to study	O	O	O	O
Studied by myself	O	O	O	O
Cheated on assignments or exams	O	O	O	O
Withdrew from the course	O	O	O	O
Studied with other students in the class	O	O	O	O
Received informal tutoring	O	O	O	O
Received academic support outside the class	O	O	O	O
Used feedback from Teacher Assistant or professor on a regular basis	O	O	O	O

Q15. **For this most challenging class, how helpful was the encouragement or advice you received from the following?**

	Did not receive/ not applicable	Received, not helpful	Received, somewhat helpful	Received, very helpful
Family member or friend	○	○	○	○
Fellow resident or Resident Assistant	○	○	○	○
Fellow classmate	○	○	○	○
Upper-class student who had taken the class	○	○	○	○
Staff person or administrator	○	○	○	○
Professional counselor	○	○	○	○
Advisor	○	○	○	○
Professor or Teacher's Assistant for this class	○	○	○	○
Academic dean	○	○	○	○
Another faculty member	○	○	○	○

Q16. **In a typical week (not exam week), how many hours did you spend studying and preparing for this class?**

- ○ 0 or None
- ○ Less than 1 hour
- ○ 1-2 hours
- ○ 3-5 hours
- ○ 6-10 hours
- ○ 11-20 hours
- ○ 21-35 hours
- ○ 36-45 hours
- ○ 46 hours or more

Q17. **Section 2: Social Capital**

What is the highest level of education completed by your parents?

	Elementary school or less	Some high school	High school graduate	Some college	Associate degree from two year college	Bachelor's degree	Some graduate school	Graduate degree	Don't know
Mother	○	○	○	○	○	○	○	○	○
Father	○	○	○	○	○	○	○	○	○

Q18. **Are you financially independent (your college expenses are paid by someone other than your parents, e.g., yourself, your employer.)?**

- ○ Yes
- ○ No

Q19. **What is your best estimate of your parents' total income last year? Consider income from all sources before taxes.**

- ○ Less than $20,000
- ○ $20,000---$39,999
- ○ $40,000---$59,999
- ○ $60,000---$79,999
- ○ $80,000 or more
- ○ I don't know

Q20. **How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to cover from each of the sources listed below?**

	None	Less than $1,000	$1,000 to $2,999	$3,000 to $5,999	$6,000 to $9,999	$10,000+	Don't know
Family resources (parents, relatives, spouse, etc.)	○	○	○	○	○	○	○
My own resources (savings from work, work-study, other income)	○	○	○	○	○	○	○
Employer contributions	○	○	○	○	○	○	○
Aid which need not be repaid (grants, scholarships, military funding, etc.)	○	○	○	○	○	○	○
Aid which must be repaid (loans, etc.)	○	○	○	○	○	○	○
Other sources than above	○	○	○	○	○	○	○

Q21. **Do you have any concern about your ability to finance your college education?**

- ○ None (I am confident that I will have sufficient funds)
- ○ Some concerns (but I probably will have enough funds)
- ○ Major concerns (not sure I will have enough funds to complete college)

Q22. **Excluding yourself, how many people (children, grandchildren, brothers, sisters, parents, etc.) are you financially supporting?**

- None
- 1 - 2
- 3 - 4
- 5 or above

Q23. **Are you currently working?**

- Yes, I am currently working on campus.
- Yes, I am currently working off campus.
- No, I am not looking for working opportunities.
- No, I am currently unemployed, but I am looking for working opportunities.

Q24. **During your time at the community college, about how many hours a week did you usually spend working on a job for pay?**

- 1 to 10 hours
- 11 to 15 hours
- 16 to 20 hours
- 21 to 30 hours
- more than 30 hours

Q25. **During high school, how often did your parents or other adults:**

	Never or very rarely	A few times a year	About once a month	Several times a month	Several times a week
Discuss book, films, or television programs with you	○	○	○	○	○
Eat the main meal with you around a table	○	○	○	○	○
Spend time just talking to you	○	○	○	○	○
Work with you on your homework	○	○	○	○	○
Discuss your progress in school with you	○	○	○	○	○
Participate in school related activities (e.g., Parent-Teacher Association)	○	○	○	○	○
Spend time talking with your friends	○	○	○	○	○

Q26. If you were to compare yourself to your parents or guardian, would you say that you are:

- ○ Much more thrifty and likely to save what I can
- ○ Somewhat more thrifty and likely to save what I can
- ○ About as thrifty
- ○ Somewhat less thrifty and more likely to spend what I can
- ○ Much less thrifty and much more likely to spend what I can

Q27. What is your mother's occupation?

Q28. What is your father's occupation?

Q29. What is your probable career occupation?

Q30. Since arriving at this college, has your occupational expectation changed?

- ○ Yes
- ○ No

Q31. **Please indicate WHY your career choice changed:**

	Strongly Disagree	Disagree	Slightly Disagree	Neither agree nor disagree	Slightly Agree	Agree	Strongly Agree
Lack of high school preparation for career choice requirements	O	O	O	O	O	O	O
Academic difficulty in the major course requirements for the career	O	O	O	O	O	O	O
Academic interests and values have changed since arriving at this college	O	O	O	O	O	O	O
Career interests have changed since arriving at this college	O	O	O	O	O	O	O
Career values have changed since arriving at this college	O	O	O	O	O	O	O
Lack of pre-professional learning opportunities available (e.g., internships, research opportunities)	O	O	O	O	O	O	O

Q32. **How likely would each of the following be to prevent you from obtaining your college degree?**

	Not at all likely	Probably not likely	Somewhat likely	Very likely
Child care issues	O	O	O	O
Health issues	O	O	O	O
Debt-need to work more hours because of bills	O	O	O	O
Inability to balance home and school responsibilities	O	O	O	O
Inability to balance work and school responsibilities	O	O	O	O
Insufficient financial aid	O	O	O	O
Lack of money	O	O	O	O
Poor or failing grades	O	O	O	O
Transportation issues	O	O	O	O
Unprepared for college coursework	O	O	O	O
Lack of support services or resources, i.e. tutoring/mentoring/counseling	O	O	O	O

Q33. **If there were no obstacles, what is the highest academic degree you would like to attain in your lifetime?**

- ○ Will take classes, but do not intend to earn a degree
- ○ Vocational certificate/Diploma
- ○ Associate degree (A.A. or equivalent)
- ○ Bachelors' degree (B.A., B.S., etc.)
- ○ At least a Bachelor' degree, maybe more
- ○ Master's degree (M.A., M.S., etc.)
- ○ Doctoral degree (Ph.D., Ed.D., J.D., etc.)
- ○ Medical degree (M.D., D.D.S., D.V.M., etc.)

Q34. **Realistically, what do you expect will be your annual income in the first full year after leaving this college?**

- ○ Less than $20,000
- ○ $20,000---$39,999
- ○ $40,000---$59,999
- ○ $60,000---$79,999
- ○ $80,000 or more

Q35. **Section 3: Transfer knowledge**

About how many hours a week do you usually spend on the community college campus, not counting time attending classes?

- ○ None
- ○ 1 to 3 hours
- ○ 4 to 6 hours
- ○ 7 to 9 hours
- ○ 10 to 12 hours
- ○ more than 12 hours

Q36. **Have you taken any developmental courses in the following subjects? (check all that apply)**

- ☐ Math
- ☐ Reading
- ☐ Writing
- ☐ None

Q37. **About how many hours a week do you usually spend studying or preparing for your classes?**

- ○ 1 to 5 hours
- ○ 6 to 10 hours
- ○ 11 to 15 hours
- ○ 16 to 20 hours
- ○ more than 20 hours

Q38. **The following items address your use of academic advising/counseling services at your community college. Please indicate the extent to which you disagree or agree with each statement.**

	Strongly Disagree	Disagree	Slightly Disagree	Neither agree nor disagree	Slightly Agree	Agree	Strongly Agree
I consulted with academic advisors/counselor regarding transfer.	○	○	○	○	○	○	○
Information received from academic advisors/counselors was helpful in the transfer process.	○	○	○	○	○	○	○
I met with academic advisors /counselors on a regular basis.	○	○	○	○	○	○	○
I talked with an advisor/counselor about courses to take, requirements, and education plans.	○	○	○	○	○	○	○
I discussed my plans for transferring to a four-year college or university with an academic advisor/counselor.	○	○	○	○	○	○	○
Advisors/counselors identified courses needed to meet the general education/major requirements of a four-year college or university I was interested in attending.	○	○	○	○	○	○	○

Q39. **The following items pertain to your perceptions about the "transfer process" while you were enrolled at the community college. Please indicate the extent to which you disagree or agree with each statement.**

	Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly Agree
I researched various aspects of 4-year institutions to get a better understanding of the environment and academic expectations.	○	○	○	○	○	○	○
I visited the 4-year institutions at least once to learn where offices and departments were located.	○	○	○	○	○	○	○
I spoke to academic counselors at 4-year institutions about transferring and major requirements.	○	○	○	○	○	○	○
I spoke to former community college transfer students to gain insight about their transfer experiences.	○	○	○	○	○	○	○

Q40. **How often did you do each of the following at your community college?**

	Never or very rarely	A few times per semester	About once a month	Several times a month	Several times a week
Visited faculty and sought their advice on class projects such as writing assignments and research papers.	O	O	O	O	O
Felt comfortable approaching faculty outside class.	O	O	O	O	O
Discussed career plans and ambitions with a faculty member.	O	O	O	O	O
Asked my instructor for comments and criticisms about my work.	O	O	O	O	O

Q41. **Have you ever felt that the faculty, staff, or administration in this college treated you poorly?**

- O Yes
- O No

Q42. **Have you ever felt that the faculty, staff, or administration in this college treated you poorly because of your: (Check all that apply).**

- ☐ Gender
- ☐ Race or ethnicity
- ☐ English-language proficiency
- ☐ Sexual orientation
- ☐ Religion
- ☐ Social class
- ☐ Other, please specify

Q43. **To what extent do the following generally characterize the classroom environment you have experienced at this college?**

	Never	Rarely	Sometimes	Often	Always
I felt I was treated respectfully in class	O	O	O	O	O
Class size made it difficult to ask questions	O	O	O	O	O
I felt isolated in class	O	O	O	O	O
Instructor expressed a lack of confidence in my ability to succeed in class	O	O	O	O	O
Instructor or students made prejudiced comments that made me uncomfortable	O	O	O	O	O
I felt like I did not fit in	O	O	O	O	O
I was ignored when I tried to participate in class discussions or ask questions	O	O	O	O	O

Q44. In your opinion, how successful has this college been at providing:

	Not at all successful	Somewhat successful	Successful	Very successful	Extremely successful
Faculty role models similar to you	○	○	○	○	○
Administrative/staff role models similar to you	○	○	○	○	○
Clubs and organizations that match your interest	○	○	○	○	○
Classroom environments that encourage your academic success	○	○	○	○	○
A sense of being a valued member of the community	○	○	○	○	○
Opportunities to interact socially with your friends	○	○	○	○	○

Q45. As things stand today, do you intend to transfer to a:

- ○ 4-year public univeristy
- ○ 4-year private college or university
- ○ Private 2-year college
- ○ Public 2-year college
- ○ Not intend to transfer

Q46. Are you planning to major in STEM (Science, Technology, Engineering, and Mathematics) upon transfer?

- ○ Yes
- ○ No

Q47. Which STEM major are you planning to choose upon transfer?

Q48. Section 4: Demographic information

Is this your first semester in this college?

- ○ Yes
- ○ No

Q49. **Thinking about this current academic term, how would you characterize your enrollment at this college?**

- ○ Full-time (12 or more credit hours)
- ○ Part-time (less than 12 credits)

Q50. **Including this semester, what mathematics courses have you taken? Include courses in high school or previous college work. (Check all that apply)**

	High School	College
Basic math, Business math, or Pre-algebra	☐	☐
Algebra I	☐	☐
Geometry	☐	☐
Algebra II	☐	☐
Trigonometry	☐	☐
Pre-calculus	☐	☐
Calculus	☐	☐
Integrated/Applied Mathematics	☐	☐
Probability/Statistics	☐	☐

Q51. **Including this semester, what science courses have you taken? Include courses in high school or previous college work. (Check all that apply)**

	High School	College
General Biology	☐	☐
Chemistry	☐	☐
Physics	☐	☐
Biology specialty (i.e., microbiology, genetics, botany, cell biology, marine biology, etc.)	☐	☐
Other Earth Sciences (i.e., geology, meterology, etc.)	☐	☐
Physical Science	☐	☐

Q52. **Have you participated in Project Lead The Way (PLTW)?**

- ○ Yes
- ○ No

Q53. Have you ever attended a four-year college/university?

- ○ Yes
- ○ No

Q54. What academic credentials have you earned? (Check all that apply)

- ☐ None
- ☐ High school diploma or GED
- ☐ AA (Associate of Arts)
- ☐ AS (Associate of Science)
- ☐ AGS (Associate of General Studies)
- ☐ AAA (Associate of Applied Arts)
- ☐ AAS (Associate of Applied Science)
- ☐ Diploma
- ☐ Certificate
- ☐ Other

Q55. What is your gender?

- ○ Male
- ○ Female

Q56. How would you identify your race/ethnic background?

- ○ American Indian or Alaska Native
- ○ Asian
- ○ Black or African American
- ○ Hispanic
- ○ Native Hawaiian or other Pacific Islander
- ○ White
- ○ Two or more races
- ○ Race/Ethnicity Unknown

Q57. What is your age?

Q58. **What is your marital status?**

- ○ Married
- ○ Living together (not married)
- ○ Single, never married
- ○ Divorced/separated/widowed

Q59. **Are your parent(s):**

- ○ Both alive and living with each other
- ○ Both alive
- ○ Divorced or living apart
- ○ One or both deceased

Q60. **What is your current religious preference?**

- ○ Catholic
- ○ Protestant
- ○ Jewish
- ○ Islam
- ○ Hindu
- ○ Buddhist
- ○ Other, please specify
- ○ None
- ○ Prefer not to answer

Q61. **How many miles is this college from your permanent home?**

- ○ 5 miles or less
- ○ 6---10 miles
- ○ 11---50 miles
- ○ 51---100 miles
- ○ 101---500 miles
- ○ Over 500 miles

Q62. **Currently, what is your citizenship status?**

- U.S. Citizen, native born
- U.S. Citizen, naturalized
- Non-U.S. Citizen, with a permanent resident visa/green card
- Non-U.S. Citizen, with a temporary U.S. resident visa
- Living outside the United States
- Prefer not to answer

Q63. **If you were born outside of the U.S., in what country were you born? Please specify.**

Q64. **At what age did you first come to the U.S. for an extended period of time (i.e., more than 1 month)? Please specify.**

- Birth to 3
- 4 to 7
- 8 to 12
- 13 to 17
- 18 to 21
- older than 21
- Not applicable

Q65. **Is English your native language?**

- Yes
- No

Q66. **Section 5 Institution Question**

Are you taking classes fully on-line?

- Yes
- No

Q67. **Please click the "NEXT" button to submit the survey. By submitting the survey, you will be automatically entered in a lottery for a random drawing for winning one of the five iPad 2. Good Luck!**

Thank you very much for taking the time to complete this survey.

Soko S. Starobin, Ph.D.
School of Education
Director, Offfice of Community College Research and Policy
Iowa State University
starobin@iastate.edu

APPENDIX B. CRITERIA FOR DEVELOPING THE MASTER DATA FILE

Community College Name September 28, 2012, Doc 1

OCCRP Campus Liaison Tracy Kruse

STEM Student Success Literacy
Creation of Master Student Data File

- Course Selection (immediately following add/drop date)
  - Courses should be selected so as to survey students who have attended at least one semester of college. Please include:
    - Only courses offered during the Fall 2012 semester that count toward degree attainment, institutional credit or towards financial aid
    - Courses specifically related to NSF grant programs (including: STEP-UP, S-STEM, etc.)
  - Exclude:
    - If courses fall within a sequence (exe: composition I, II, III), exclude all level I or prerequisite level courses
    - Remedial/developmental courses
    - Courses that may begin after the add/drop date
    - Non-credit courses
    - Dual enrollment courses offered entirely to high school students
    - Freshman seminar or other courses offered specifically to first-term freshmen students (open to discussion)
    - Lower-level ESL courses in which students may not have adequate English proficiency to complete the survey
    - Independent study courses
    - Individual instruction courses (exe: music lessons)
    - Distance education courses (including: hybrid, online and ICN)
- Following course selection – student data should be pulled based on the items agreed upon in the "SSSL Student Demographic Wish List.

The STEM Student Success Literacy project is directed by Dr. Soko Starobin, Assistant Professor, School of Education and Director of Office of Community College Research and Policy at Iowa State University (ISU), based on a multi-year research study entitled, *Measuring Constructs of STEM Student Success Literacy: Community College Students' Self-Efficacy, Social Capital, and Transfer Knowledge*, funded through the College of Human Sciences at ISU

This document is published by the Office of Community College Research & Policy (OCCRP) in the School of Education, College of Human Sciences at Iowa State University. **http://www.cclp.hs.iastate.edu**

Office of Community College Research and Policy
School of Education
Iowa State University
N243 Lagomarcino Hall
Ames, Iowa

Soko S. Starobin, *Editor*
Assistant Professor and Director of OCCRP
Phone: 515-294-9121, Fax: 515-294-4942
starobin@iastate.edu
www.cclp.hs.iastate.edu/research/occrp

APPENDIX C. STUDY CODEBOOK

Variable	Description	Code	Purpose
Intention to Transfer to 4 year in STEM		**Transfer_STEM**	
45, 46	Transfer intentions	0=Do not intend to transfer; 1=intend to transfer in non-STEM field; 2=intend to transfer in STEM	endogenous variable
College Math and Science Preparation		**College_MS_Prep**	
50,51	How many college level math and science courses have you taken?	Responses range from 0-15	measurement model- observed variable
Family Member/Friend Encouragement		**Fam_enc**	
15_1	For this most challenging class, how helpful was the encouragement or advice you received from the following? Family member or friend	did not receive/na=1; received, not helpful=2, received, somewhat helpful=3; received, very helpful=4	measurement model- observed variable
Parent Education		**Par_educ**	
17_1, 17_2	What is the highest level of education completed by your parents?	neither parent holds a bachelor degree or higher =0, one or more parents holds a bachelor degree=1	measurement model- observed variable
Workstudy		**Workstudy**	
23, 24	Workstudy Position on Campus	0=No; 1= Yes	measurement model- observed variable
Financial Aid Sources		**Financial_aid**	
20_1	How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to cover from each of the sources listed below? Family resources (parents, relatives, spouse, etc.)	none; less than $1000; $1K-$2,999, $3k-$5,999; $6k-$9,999; $10k+; Don't know	CFA - financial aid construct

20_4	How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to cover from each of the sources listed below? Aid which need not be repaid (grants, scholarships, military funding, etc.)	none; less than $1000; $1K-$2,999, $3k-$5,999; $6k-$9,999; $10k+; Don't know	CFA - financial aid construct
20_5	How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to cover from each of the sources listed below? Aid which needs to be repaid (loans, etc.)	none; less than $1000; $1K-$2,999, $3k-$5,999; $6k-$9,999; $10k+; Don't know	CFA - financial aid construct
20_6	If you were to compare yourself to your parents or guardian, would you say that you are	1 = "Much more thrifty and likely to save what I can"; 2 = "Somewhat more thrifty and likely to save what I can"; 3 = "About as thrifty"; 4 = "Somewhat less thrifty and more likely to spend what I can"; 5 = "Much less thrifty and much more likely to spend what I can"	CFA - financial aid construct
Financial Concerns		**Fin_conc**	
22	Do you have any concern about your ability to finance your college education?	1="none"; 2= "some concerns"; 3="major concerns"	CFA - financial concerns construct
32_3	How likely would each of the following be to prevent you from obtaining your college degree? -Debt-need to work more hours because of bills	1 = "Not at all likely"; 2 = "Probably not likely"; 3 = "Somewhat likely"; 4 = "Very likely"	CFA - financial concerns construct
32_6	How likely would each of the following be to prevent you from obtaining your college degree? -Insufficient financial aid	1 = "Not at all likely"; 2 = "Probably not likely"; 3 = "Somewhat likely"; 4 = "Very likely"	CFA - financial concerns construct

32_7	How likely would each of the following be to prevent you from obtaining your college degree? -Lack of money	1 = "Not at all likely"; 2 = "Probably not likely"; 3 = "Somewhat likely"; 4 = "Very likely"	CFA - financial concerns construct
Environmental Pull Factors		**Env_Pull**	
22	Excluding yourself, how many people (children, grandchildren, brothers, sisters, parents, etc.) are you financially supporting?	none = 1; 1-2 =2; 3-4=3; 5 or more=4	CFA - Environmental Pull Factors Construct
24	During your time at the community college, about how many hours a week did you usually spend working...	0=Doesn't work; 1 =1 to 10 hours, 2 = 11 to 15 hours, 3 = 16 to 20 hours; 4 = 21 to 30 hours; 5 = more than 30 hours	CFA - Environmental Pull Factors Construct
32_4	How likely would each of the following be to prevent you from obtaining your college degree? -Inability to balance home and school responsibilities	1 = "Not at all likely"; 2 = "Probably not likely"; 3 = "Somewhat likely"; 4 = "Very likely"	CFA - Environmental Pull Factors Construct
32_5	How likely would each of the following be to prevent you from obtaining your college degree? -Inability to balance work and school responsibilities	1 = "Not at all likely"; 2 = "Probably not likely"; 3 = "Somewhat likely"; 4 = "Very likely"	
Parent Involvement in High School		**Par_inv_HS**	
25_6	During high school, how often did your parents or other adults:-Discuss book, films, or television programs with you	1 = "Never or very rarely";2 = "A few times a year"; 3 = "About once a month"; 4 = "Several times a month"; 5 = "Several times a week"	CFA - Social Capital Construct
25_7	During high school, how often did your parents or other adults:-Eat the main meal with you around a table	2 = "Never or very rarely";2 = "A few times a year"; 3 = "About once a month"; 4 = "Several times a month"; 5 = "Several times a week"	CFA - Social Capital Construct

25_8	During high school, how often did your parents or other adults:-Spend time just talking to you	3 = "Never or very rarely";2 = "A few times a year"; 3 = "About once a month"; 4 = "Several times a month"; 5 = "Several times a week"	CFA - Social Capital Construct
25_9	During high school, how often did your parents or other adults:-Work with you on your homework	4 = "Never or very rarely";2 = "A few times a year"; 3 = "About once a month"; 4 = "Several times a month"; 5 = "Several times a week"	CFA - Social Capital Construct
25_10	During high school, how often did your parents or other adults:-Discuss your progress in school with you	5 = "Never or very rarely";2 = "A few times a year"; 3 = "About once a month"; 4 = "Several times a month"; 5 = "Several times a week"	CFA - Social Capital Construct
Community College Advising		**CC_Advising**	
38_1	The following items address your use of academic advising/counseling services at your community college-I consulted with academic advisors/counselor regarding transfer.	1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Slightly Disagree"; 5 = "Slightly Agree"; 6 = "Agree"; 7 = "Strongly Agree"; 8 = "Neither agree nor disagree"	CFA - Social Capital Construct
38_2	The following items address your use of academic advising/counseling services at your community college-Information received from academic advisors/counselors was helpful in the transfer process.	1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Slightly Disagree"; 5 = "Slightly Agree"; 6 = "Agree"; 7 = "Strongly Agree"; 8 = "Neither agree nor disagree"	CFA - Social Capital Construct
38_3	The following items address your use of academic advising/counseling services at your community college-I met with academic advisors /counselors on a regular basis.	1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Slightly Disagree"; 5 = "Slightly Agree"; 6 = "Agree"; 7 = "Strongly Agree"; 8 = "Neither agree nor disagree"	CFA - Social Capital Construct

38_4	The following items address your use of academic advising/counseling services at your community college-I talked with an advisor/counselor about courses to take, requirements, and education plans.	1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Slightly Disagree"; 5 = "Slightly Agree"; 6 = "Agree"; 7 = "Strongly Agree"; 8 = "Neither agree nor disagree"	CFA - Social Capital Construct
38_5	The following items address your use of academic advising/counseling services at your community college-I discussed my plans for transferring to a four-year college or university with an academic advisor/counselor.	1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Slightly Disagree"; 5 = "Slightly Agree"; 6 = "Agree"; 7 = "Strongly Agree"; 8 = "Neither agree nor disagree"	CFA - Social Capital Construct
38_6	The following items address your use of academic advising/counseling services at your community college-Advisors/counselors identified courses needed to meet the general education/major requirements of a four-year college or university I was interested in attending.	1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Slightly Disagree"; 5 = "Slightly Agree"; 6 = "Agree"; 7 = "Strongly Agree"; 8 = "Neither agree nor disagree"	CFA - Social Capital Construct

APPENDIX D. INSTITUTIONAL REVIEW BOARD (IRB) EXEMPTION

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

DATE: March 23, 2012

TO: Soko Starobin
N243 Lagomarcino Hall

FROM: Office for Responsible Research

TITLE: **Measuring Constructs of STEM Student Success Literacy: Community College Students' Self-Efficacy, Social Capital, and Transfer Knowledge**

IRB ID: **12-124**

Submission Type: New **Exemption Date:** March 23, 2012

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any *modifications to the research procedures* (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the *inclusion of participants from vulnerable populations*, and/or any *change that may increase the risk or discomfort to participants*. *Changes to key personnel* must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or its designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

ORR 08/2011

APPENDIX E. CORRELATION MATRIX

Q No.	17-1	17-2	15-1	20-1	20-4	20-5	25-4	25-5	25-6	25-7	25-8	25-9	25-10	32-3	32-6	32-7	32-4	32-5	38-1	38-2	38-3	38-4	38-6	39-1	39-3	39-4	39-6	21	22	24
17-1	—																													
17-2	.434**	—																												
15-1	–.027	–.013	—																											
20-1	.150**	.127**	.027	—																										
20-4	–.049**	–.053**	.013	.116**	—																									
20-5	–.052**	–.075**	.020	.085**	.344**	—																								
25-4	.165**	.077**	.094**	.121**	–.036*	–.029	—																							
25-5	.112**	.068**	.121**	.067**	–.032*	–.006	.517**	—																						
25-6	.178**	.140**	.099**	.075**	–.042**	–.063**	.360**	.444**	—																					
25-7	.069**	.031*	.091**	.048**	–.061**	–.052**	.363**	.361**	.354**	—																				
25-8	.120**	.064**	.094**	.073**	–.058**	–.063**	.395**	.542**	.483**	.503**	—																			
25-9	.152**	.096**	.174**	.112**	.004	.008	.587**	.481**	.429**	.407**	.460**	—																		
25-10	.168**	.116**	.119**	.124**	–.034*	–.034*	.554**	.545**	.512**	.453**	.612**	.627**	—																	
32-3	–.048**	–.060**	–.019	–.154**	.010	.165**	–.144**	–.090**	–.071**	–.101**	–.108**	–.100**	–.140**	—																
32-6	–.069**	–.062**	–.007	–.129**	.042**	.174**	–.136**	–.112**	–.059**	–.093**	–.116**	–.093**	–.123**	.591**	—															
32-7	–.059**	–.051**	–.014	–.127**	.037*	.169**	–.156**	–.112**	–.073**	–.107**	–.107**	–.107**	–.131**	.687**	.810**	—														
32-4	–.022	–.027	–.021	–.057**	.010	.059**	–.094**	–.064**	–.053**	–.069**	–.084**	–.071**	–.111**	.449**	.339**	.368**	—													
32-5	–.005	–.013	–.044**	–.060**	–.046**	.028	–.088**	–.059**	–.023	–.078**	–.052**	–.074**	–.074**	.518**	.374**	.414**	.693**	—												
38-1	.023	.045**	.044**	.065**	–.017	–.034*	.044**	.054**	.075**	.017	.040**	.025	.054**	.016	.034*	.024	–.017	.007	—											
38-2	.016	.020	.048**	.055**	.000	–.015	.056**	.070**	.083**	.038*	.058**	.028	.073**	.008	.028	.015	–.014	.004	.769**	—										
38-3	–.025	–.034*	.041**	.026	.076**	.041**	.079**	.048**	.031*	.042**	.025	.069**	.031*	–.003	.024	.012	–.025	–.050**	.473**	.481**	—									
38-4	–.028	–.014	.085**	.022	.049**	.005	.033*	.047**	.048**	.036*	.049**	.037*	.042**	.007	.035*	.027	–.043**	–.038*	.450**	.459**	.517**	—								
38-6	.035*	.030*	.030	.068**	.026	–.041**	.029	.047**	.067**	.002	.016	.023	.045**	.007	.035*	.020	–.008	.023	.708**	.616**	.499**	.474**	—							
39-1	.065**	.045**	.036*	.065**	–.006	–.034*	.070**	.059**	.097**	.030*	.045**	.043**	.075**	.007	.053**	.020	–.019	.019	.442**	.383**	.268**	.188**	.514**	—						
39--3	.087**	.065**	.029	.098**	–.004	–.017	.103**	.059**	.091**	.026	.042**	.054**	.085**	–.015	.009	.004	–.016	.005	.374**	.316**	.259**	.127**	.409**	.591**	—					
39-4	.037*	.030*	.031*	.073**	–.002	–.015	.074**	.042**	.079**	.042**	.030	.045**	.056**	–.003	.029	.009	–.014	.002	.442**	.370**	.294**	.167**	.488**	.626**	.734**	—				
39-6	.043**	.012	.050**	.054**	.005	–.031*	.083**	.060**	.062**	–.002	.022	.039**	.059**	.005	–.005	–.010	–.042**	–.002	.356**	.331**	.316**	.169**	.401**	.499**	.498**	.503**	—			
21	–.059**	–.048**	–.026	–.099**	.015	.138**	–.120**	–.112**	–.065**	–.119**	–.129**	–.107**	–.133**	.464**	.521**	.541**	.202**	.254**	.054**	.025	.030	.002	.062**	.076**	.049**	.046**	.036*	—		
22	–.165**	–.128**	.061**	–.190**	.122**	.126**	–.068**	–.046**	–.125**	–.033*	–.149**	–.039*	–.153**	.186**	.121**	.139**	.207**	.067**	–.033*	–.028	.041**	.025	–.044**	–.089**	–.096**	–.045**	–.079**	.041**	—	
24	.009	–.012	–.001	–.127**	–.164**	–.093**	.028	.044**	.040**	.001	.056**	.015	.050**	.087**	.008	–.011	.063**	.223**	.039*	.015	–.051**	–.020	.018	.032*	.012	.012	.015	–.001	–.014	—

Note. Listwise $N = 4{,}294$.

*Significant at the 0.05 level (2-tailed).**Significant at the 0.01 level (2-tailed).

REFERENCES

American Association of Community Colleges. (2012). *Reclaiming the American dream: Community colleges and the nation's future*. Retrieved from http://www.aacc.nche.edu/aboutcc/21stcenturyreport/21stCenturyReport.pdf

Annie E. Casey Foundation. (2011). *How third-grade reading skills and poverty influence high school graduation.* Retrieved from http://www.aecf.org/~/media/Pubs/Topics/Education/Other/DoubleJeopardyHowThirdGradeReadingSkillsandPovery/DoubleJeopardyReport040511FINAL.pdf

Arbuckle, J. L. (1995). *Amos user's guide* [Computer software]. Chicago, IL: Smallwaters.

Archer, L., & Hutchings, M. (2000). "Bettering yourself"? Discourses of risk, cost and benefit in ethnically diverse, young working-class non-participants' constructions of higher education. *British Journal of Sociology of Education, 21*, 555–574.

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

Bailey, M. J., & Dynarski, S. M. (2011). *Gains and gaps: Changing inequality in U.S. college entry and completion* (National Bureau of Economic Research working paper No. 17633). Retrieved from http://papers.nber.org/tmp/87811-w17633.pdf

Bailey, T., Calcagno, J. C., Jenkins, D., Leinbach, T., & Kienzl, G. (2006). Is student-right-to-know all you should know? An analysis of community college graduation rates. *Research in Higher Education*, *47*, 491–519.

Baum, S., & Ma, J. (2011). *Trends in college pricing* (Trends in Higher Education series). Washington, DC: College Board.

Bean, J. P. (1982). Student attrition, intentions, and confidence: Interaction effects in a path model. *Research in Higher Education*, *17*, 291–320.

Bean, J. P., & Metzner, B. S. (1985). A conceptual model of nontraditional undergraduate student attrition. *Review of Educational Research, 55*, 485–540.

Berger, J. B. (2000). Optimizing capital, social reproduction, and undergraduate persistence. In J. M. Braxton (Ed.), *Reworking the student departure puzzle* (pp. 95–124). Nashville, TN: Vanderbilt University Press.

Berkner, L., He, S., Mason, M., Wheeless, S., & Hunt-White, T. (2007). *Persistence and attainment of 2003-04 beginning postsecondary students: After three years. First look* (NCES 2007-169). Washington, DC: National Center for Education Statistics.

Bettinger E. P., Long, B. T., & Oreopoulos, P. (n.d.). *Increasing postsecondary enrollment among low-income families: A project to improve access to college information and financial aid. The FAFSA H&R Block experiment.* Retrieved from http://www.aypf.org/documents/NewFAFSAHRBlock-preferreddescription.pdf

Bound, J., Lovenheim, M., & Turner, S. (2009). *Why have college completion rates declined? An analysis of changing student preparation and collegiate resources* (No. w15566). Cambridge, MA: National Bureau of Economic Research

Bourdieu, P. (1973). Cultural reproduction and social reproduction. *Knowledge Education and Cultural Change Papers in the Sociology of Education*, *10*(2), 71–112.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). New York, NY: Greenwood Press.

Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton, NJ: Princeton University Press.

Braeden, M. C. (2008). Teacher-quality gap examined worldwide. *Education Week.* Retrieved from http://www.edweek.org/ew/articles/2008/02/06/22report-1.h27.html?qs=Teacher-quality+gap+examined+worldwide

Braxton, J. M. (Ed.). (2000). *Reworking the student departure puzzle*. Nashville, TN: Vanderbilt University Press.

Broughton, E., & Otto, S. (1999). On-campus student employment: Intentional learning outcomes. *Journal of College Student Development, 40*, 87–89.

Brown, M., Haughwout, A., Lee, D., Mabutas, M., & Ven der Klaauw, W. (2012). *Grading student loans.* Federal Reserve Bank of New York. Retrieved from http://libertystreeteconomics.newyorkfed.org/2012/03/grading-student-loans.html

Burdman, P. (2005).*The student debt dilemma: Debt aversion as a barrier to college. A discussion paper for Institute for College Access and Success*. Berkeley: Center for Studies in Higher Education, University of California–Berkeley. Retrieved from http://cshe.berkeley.edu/publications /docs/ROP.Burdman.13.05.pdf

Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. New York, NY: Routledge.

Cabrera, A. F., Nora, A., & Castaneda, M. B. (1992). The role of finances in the persistence process: A structural model. *Research in Higher Education, 33*, 571–593.

Cabrera, A. F., Nora, A., & Castaneda, M. B. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. *Journal of Higher Education, 64*(2), 123–139.

Callender, C., & Jackson, J. (2005). Does the fear of debt deter students from higher education? *Journal of Social Policy, 34*(4), 509–540.

Cannon, A. (2012a). *Up and down: Regents' costs rise, funding drops in Iowa.* Iowa Policy Project. Retrieved from http://www.iowapolicyproject.org/2012docs/120308-IFP-regents.pdf

Cannon, A. (2012b*). Lost momentum for Iowa's community colleges.* Iowa Policy Project. Retrieved from http://www.iowapolicyproject.org/2012docs/120322-IFP-commcoll.pdf

Chen, R., & DesJardins, S. L. (2008). Exploring the effects of financial aid on the gap in student dropout risks by income level. *Research in Higher Education, 49*, 1–18.

Chiu, M. M. (2010). Effects of inequality, family and school in mathematics achievement: Country and student differences. *Social Forces, 88*(4), 1645–1676.

Coley, R. J. (2000). *The American community college turns 100: A look at its students, programs, and prospects.* Princeton, NJ: Educational Testing Service.

Costello, C. (n.d.). Increasing opportunities for low income women and student parents in science, technology, engineering and math at community colleges. Washington, DC: Institute for Women's Policy Research.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Crisp, G., & Nora, A. (2010). Hispanic student success: Factors influencing the persistence and transfer decisions of Latino community college students enrolled in developmental education. *Research in Higher Education, 51,*175–194.

Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic Serving Institution. *American Educational Research Journal, 46*(4), 924—942.

Croninger, R. G., & Lee, V. E. (2001). Social capital and dropping out of high school: Benefits to at-risk students of teachers' support and guidance. *Teachers College Record, 103*(4), 548–581.

Curran, P. J., West, S. G., & Finch, F. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods, 1*(1), 16–29.

Davies, E., & Lea, S. (1995). Student attitudes to student debt. *Journal of Economic Psychology, 16*, 663– 679.

Dennis, J. M., Phinney, J. S., & Chuateco, L. I. (2005). The role of motivation, parental support, and peer support in the academic success of ethnic minority first-generation college students. *Journal of College Student Development*, *46*, 223–236.

DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (2002). A temporal investigation of factors related to timely degree completion. *Journal of Higher Education, 73*, 555–581.

Dowd, A. C. (2004). Income and financial aid effects on persistence and degree attainment in public colleges. *Education Policy Analysis Archives*, *12*(21), 1–33.

Dowd, A. C. (2008). Dynamic interactions and intersubjectivity: Challenges to causal modeling in studies of college student debt. *Review of Educational Research*, *78*(2), 232–259.

Dowd, A. C., & Coury, T. (2006). The effect of loans on the persistence and attainment of community college students. *Research in Higher Education, 47*(1), 33–62.

French, L., Fisher, P. S., & O'Connor, N. (2011). *The cost of living in Iowa: 2011 edition.* Iowa Policy Project. Retrieved from http://www.iowapolicyproject.org/2012docs /120531-COL.pdf

Furstenberg, F. F., Cook, T. D., Eccles, J., Elder, G. H., Jr., & Sameroff, A. (1999). *Managing to make it: Urban families and adolescent success.* Chicago, IL: University of Chicago Press.

Garson, G. D. (2012). *Structural equation modeling* (Statistical Associates "Blue Book" series, Kindle ed.). Statistical Associates. Retrieved from http://www.statisticalassociates.com/sem.htm

Gladieux, L., & Perna, L. (2005). *Borrowers who drop out: A neglected aspect of the college student loan trend* (National Center report no. 05-2). San Jose, CA: National Center for Public Policy and Higher Education.

Gross, J., Hossler, D., & Ziskin, M. (2007). Institutional aid and student persistence: An analysis of the effects of campus-based financial aid at public four-year institutions. *NASFAA Journal of Student Financial Aid, 37*(1), 29–39.

Hagedorn, L. S., & Cepeda, R. (2004). Serving Los Angeles: Urban community colleges and educational success among Latino students. *Community College Journal of Research and Practice*, *28*(3).

Hagedorn, L. S., Cypers, S., & Lester, J. (2008). Looking in the review mirror: Factors affecting transfer for urban community college students. *Community College Journal of Research and Practice*, *32*, 643–664.

Hagedorn, L. S., & DuBray, D. (2010). Math and science success and nonsuccess: Journeys within the community college. *Journal of Women and Minorities in Science and Engineering, 16*(1), 31–50.

Hagedorn, L. S., Moon, H. S., Cypers, S., Maxwell, W. E., & Lester, J. (2006). Transfer between community colleges and four-year colleges: The all-American game. *Community College Journal of Research and Practice, 30*, 223–242.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55.

Huang, G., Taddese, N., & Walter, E. (2000). *Entry and persistence of women and minorities in college science and engineering education.* Washington, DC: National Center for Education Statistics.

Hurtado, S., Carter, D. F., & Spuler, A. (1996). Latino student transition to college: Assessing difficulties and factors in successful college adjustment. *Research in Higher Education, 37*, 135–157.

Immerwahr, J. (2003). With diploma in hand: Hispanic high school seniors talk about their future. Retrieved from http://www.highereducation.org/reports/hispanic /hispanic.shtml

Iowa Coordinating Council on Post-High School Education. (2011). *Iowa college and university enrollment report, Fall 2011*. Retrieved from http://www.regents.iowa.gov /ICCPHSE/IowaEnrollmentReport2011.pdf

Iowa College Student Aid Commission. (2010a). *The condition of higher education in Iowa*. Des Moines, IA: Author. Retrieved from https://apps.iowacollegeaid.gov/marketing /docs/ConditionOfHigherEducation.pdf

Iowa College Student Aid Commission. (2010b). *Student loan debt at Iowa colleges and universities, class of 2010*. Des Moines, IA: Author. Retrieved from https://apps.iowacollegeaid.gov/marketing/docs/StudentLoanDebtByInstitution.pdf

Iowa Department of Education. (2011a). *2011 Iowa condition of education report.* Retrieved from http://educateiowa.gov/index.php?option=com_content&view=article&id=2565:2011-annual-condition-of-education-report-is-available&catid=666:highlights

Iowa Department of Education (2011b). *The annual condition of Iowa's community colleges 2011.* Retrieved from http://educateiowa.gov/index.php?option=com_content&view=article&id=2758&Itemid=2884

Iowa Math Science Education Partnership. (2011). *Iowa STEM education roadmap*. Retrieved from http://cesmee.hs.iastate.edu/resources/statewide/STEM%20Education%20Roadmap%202011.pdf

Iowa Workforce Development. (2011). Iowa economy. *Iowa Workforce Development News and Trends*. Retrieved from http://www.iowaworkforce.org/trends/mediania.html

Kanter, M. (2013, February). Keynote address. Legislative Summit of the Association of Community College Trustees, Washington, DC

Katsinas, S. G., & Freidel, J. N. (2010). *Uncertain recovery: Access and finance issues in public higher education. Findings from the 2010 Survey of the National Council of State Directors of Community Colleges.* Tuscaloosa, AL: Education Policy Center, The University of Alabama. Retrieved from http://education.ua.edu/wp-content/uploads/2010/11/2010-Uncertain-Recovery-10-27-2010.pdf

Katsinas, S. G., Mensel, R. F., Hagedorn, L. S., Friedel, J. N., & D'Amico (2012). Pell grants and the lifting of rural America's future. Retrieved from http://www.aascu.org/WorkArea/DownloadAsset.aspx?id=5175

Kerysa, P. G. (2007). The impact of remediation on persistence of under-prepared college students. *Journal of College Student Retention: Research, Theory, and Practice, 8*(2), 251–270.

Kim, D. H., & Schneider, B. (2005). Social capital in action: alignment of parental support in adolescents' transition to postsecondary education. *Social Forces, 84*(2), 1181–1206.

Kim, J. (2012). Exploring the relationship between state financial aid policy and postsecondary enrollment choices: A focus on income and race differences. *Research in Higher Education, 53,* 123–151.

Kim, J., DesJardins, S., & McCall, B. (2009). Exploring the effects of student expectations about financial aid on postsecondary choice: A focus on income and racial/ethnic differences. *Research in Higher Education, 50*(8), 741–774.

King, J. E. (1999). *Money matters: The impact of race/ethnicity and gender on how students pay for college* (American Council on Education Publication No. ED 443 364). Washington, DC: American Council on Education.

King, J. (2004). *Missed opportunities: Students who do not apply for financial aid.* Washington, DC: American Council on Education.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: Guilford Press.

Krapfl, A. (2012). Despite cost trend, student debt is inching downward. *Inside Iowa State for Faculty and Staff.* Ames: Iowa State University. Retrieved from http://www.inside.iastate.edu/article/2012/02/23/debt

Laanan, F. S. (2003). Degree aspirations of two-year college students. *Community College Journal of Research and Practice, 27*, 495–518.

Latino students lag behind in financial aid for college, report reveals. (2005). *Diverse Issues in Higher Education*, *22*(14), 16–17.

Lee, J., Jr., & Rawls, A. (2010). *The college completion agenda: 2010 progress report. Executive summary.* New York, NY: The College Board Advocacy & Policy Center.

Lee, V. E., & Frank, K. A. (1990). Students' characteristics that facilitate the transfer from two-year to four-year colleges. *Sociology of Education*, 178–193.

Lee, V. E., Mackie-Lewis, C. & Marks, H. M. (1993). Persistence to the baccalaureate degree for students who transfer from community college. *American Journal of Education*, 80–114.

Little, R. J., & Rubin, D. B. (1987). *Statistical analysis with missing data* (Vol. 4). New York, NY: Wiley.

Little, R. J., & Rubin, D. B. (1989). The analysis of social science data with missing values. *Sociological Methods and Research, 18*, 292–326.

Malcom, L. E., & Dowd, A. C. (2012). The impact of undergraduate debt on the graduate school enrollment of STEM baccalaureates. *Review of Higher Education*, *35*(2), 265–305.

Mallette, B. I., & Cabrera, A. F. (1991). Determinants of withdrawal behavior: An exploratory study. *Research in Higher Education, 32*(1), 179–194.

McDonough, P. M. (1994). Buying and selling higher education: The social construction of the college applicant. *Journal of Higher Education, 62*(4), 427–446.

McDonough, P. M. (1998). Structuring college opportunities: A cross-case analysis of organizational cultures, climates, and habiti. In C. A. Torres & T. R. Mitchell (Eds.), *Sociology of education: Emerging perspectives* (pp. 181–210). Albany, NY: SUNY.

McDonough, P. M., & Calderone, S. (2006). The meaning of money: Perceptual differences between college counselors and low-income families about college costs and financial aid. *American Behavioral Scientist, 49*(12), 1703–1718.

McGrath, M., & Braunstein, A. (1997). The prediction of freshmen attributes: An examination of the importance of certain demographics, academic, financial and social factors. *College Student Journal, 31*(3), 396–408.

Mertler, C. A., & Vannatta, R. A. (2010). *Advanced and multivariate statistical methods: Practical applications and interpretation*. Glendale, CA: Pyrcazak.

Metzner, B. S., & Bean, J. P. (1987). The estimation of a conceptual model of nontraditional undergraduate student attrition. *Research in Higher Education, 27*(1), 15–38.

Miller, K, Danner, F., & Staten, R. (2008). Relationship of work hours with selected health behaviors and academic progress among a college student cohort. *Journal of American College Health, 56*(6), 675–680.

Moreno, S. E. (1998). U.S. Latinos and higher education. *IUPLR Briefing Papers, 1*(6), 1–6.

Mullins, C. (2011). *The road ahead: A look at trends in the educational attainment of community college students*. Washington, DC: American Association of Community Colleges.

National Association of State Student Grant and Aid Programs. (2010). *41st annual survey report on state-sponsored student financial aid 2009-2010 academic year.* Retrieved from http://www.nassgap.org/viewrepository.aspx?categoryID=3

National Center for Education Statistics. (2011). *The condition of education*. Retrieved from http://nces.ed.gov/programs/coe/index.asp

National Student Clearinghouse. (n.d.). *National student clearinghouse*. Herndon, VA: Author. Retrieved from http://www.studentclearinghouse.org/

Nora, A. (1990). Campus-based programs as determinants of retention among Hispanic college students. *Journal of Higher Education, 61*(3): 312–331.

Nora, A. (2003). Access to higher education for Hispanic students: Real or illusory? In J. Castellanos & L. Jones (Eds.), *The majority in the minority: Expanding the*

representation of Latina/o faculty, administrators and students in higher education (pp. 47–68). Herndon, VA: Stylus.

Nora, A., & Cabrera, A. F. (1996). The role of perceptions of prejudice and discrimination on the adjustment of minority students to college. *Journal of Higher Education, 67*(2), 120–148.

Nora, A., Cabrera, A. F., Hagedorn, L. S., & Pascarella, E. T. (1996). Differential impacts of academic and social experiences on college-related behavioral outcomes across different ethnic and gender groups at four-year institutions. *Research in Higher Education, 37*(4), 427–451.

Novak, H., & McKinney, L. (2011).The consequences of leaving money on the table: Examining persistence among students who do not file a FAFSA. *Journal of Student Financial Aid, 41*(3), 6–23.

O'Connor, N., Hammack, F., & Scott, M. (2009). Social capital, financial knowledge, and Hispanic student college choices. *Research in Higher Education, 51,* 195–219. doi:10.1007/s11162-009-9153-8.

Office of the Governor of Iowa. (2011). *Gov. Branstad signs Executive Order 74; creates Governor's STEM Advisory Council.* Retrieved from https://governor.iowa.gov /2011/07/gov-branstad-signs-executive-order-74-creates-governor%E2%80%99s-stem-advisory-council/

Okun, M. A., Benin, M., & Brandt-Williams, A. (1996). Staying in college: Moderators of the relation between intention and institutional departure. *Journal of Higher Education, 67*(5), 577–596.

Olobatuyi, M. E. (2006). *A user's guide to path analysis*. Lanham, MD: University Press of America.

Palmer, J. C., & Franklin, D. (2011). *Grapevine compilation of state higher education tax appropriations for fiscal year 2007.* Normal, IL: Center for the Study of State Policy, Illinois State University.

Pascarella, E., & Terenzini, P. (1991). *How college affects students. Findings and insights from twenty years of research.* San Francisco, CA: Jossey-Bass.

Pascarella, E., & Terenzini, P. (2005). *How college affects students. A third decade of research.* San Francisco, CA: Jossey-Bass.

Pascarella, E. T., Wolniak, G. C., Pierson, C. T., Terenzini, P. T., & Schuh, J. H. (2003). Experiences and outcomes of first-generation students in community colleges. *Journal of College Student Development, 44*(3), 420–429.

Paulsen, M. B., & St. John, E. P. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *Journal of Higher Education, 73*(2), 189–236.

Penrose, A. (2002). Academic literacy perceptions and performance: Comparing first-generation and continuing-generation college students. *Research in the Teaching of English, 36*(4), 437–461.

Perna, L.W. (2000). Differences in the decision to attend college among African Americans, Hispanics, and Whites. *Journal of Higher Education, 71*(2), 117–141.

Perna, L. (2004). *Impact of student aid program design, operations, and marketing on the formation of family college-going plans and resulting college-going behaviors of potential students*. Retrieved from http://174.133.199.34/pdf/research-studies/ReseachReport_Perna.pdf

Porter, S. R. (2004). Raising response rates: What works? In S. R. Porter (Ed.), *Overcoming survey research problems* (pp. 5–21). San Francisco, CA: Jossey-Bass.

Prescott, B. (2008*). Knocking at the college door: Projections of high school graduates by state and race/ethnicity, 1992–2022.* Boulder, CO: Western Interstate Commission for Higher Education.

Price, D. V. (2004). Educational debt burden among student borrowers: An analysis of the baccalaureate and beyond panel, 1997 follow-up. *Research in Higher Education, 45*(7), 701–737.

Project on Student Debt. (2011). *Student debt and the class of 2010.* Retrieved from http://projectonstudentdebt.org/files/pub/classof2010.pdf

Provasnik, S., Kewal Ramani, A., Coleman, M. M., Gilbertson, L., Herring, W., & Xie, Q. (2007). *Status of education in rural America* (NCES 2007-040). Washington, DC: National Center for Education Statistics.

Pusser, B. & Levin, J. (2009). *Re-imagining community colleges in the 21st century: A student-centered approach to higher education*. Washington, DC: Center for American Progress. Retrieved from http://www.americanprogress.org/wp-content/uploads/issues/2009/12/pdf/community_colleges_reimagined.pdf

Reason, R. D. (2009). An examination of persistence research through the lens of a comprehensive conceptual framework. *Journal of College Student Development, 50*(6), 659–682.

Rendon, L. I., Jalomo, R., & Nora, A. (2001). Minority student persistence. In J. Braxton (Ed.), *Rethinking the departure puzzle: New theory and research on college student retention.* Nashville, TN: Vanderbilt University Press.

Rising Above the Gathering Storm Committee. (2007). *Rising above the gathering storm: Energizing and employing America for a brighter economic future.* Washington, DC: National Academy of Sciences, National Academy of Engineering, & Institute of Medicine. Retrieved from http://www.nap.edu/catalog/11463.html

Rubin, R. B. (1987). *Multiple imputation for nonresponse in surveys*. New York, NY: John Wiley and Sons.

Santiago, D. (2007). VOCES (Voices): A profile of today's Latino college students. *Excelencia in Education*, 1–11.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. London, UK: Chapman and Hall.

Schenk, T., Jr., Laanan, F. S., Starobin, S. S., Rethwisch, D., Moeller, D., & Chapman, M. (2012). *An evaluation of Iowa Project Lead The Way on student outcomes: Summary report.* Ames, IA: Office of Community College Research and Policy, Iowa State University.

Scott, T. P., Tolson, H., & Huang, T. (2009). Predicting retention of mathematics and science majors. *Journal of College Admission, 204*, 21–24.

Singell, L. D. (2002). *Come and stay awhile: Does financial aid effect enrollment and retention at a large public university?* Eugene, OR: University of Oregon.

Spera, C., Wentzel, K. R., & Matto, H. C. (2009). Parental aspirations for their children's educational attainment: Relations to ethnicity, parental education, children's academic performance, and parental perceptions of school climate. *Journal of Youth and Adolescence, 38*(8), 1140–1152.

St. John, E. P. (1990). Price response in persistence decisions: An analysis of the high school and beyond senior cohort. *Research in Higher Education, 31*(4), 387–403.

St. John, E. P. (2006). Contending with financial inequality: Rethinking the contributions of qualitative research to the policy discourse on college access. *American Behavioral Scientist, 49*(12), 1604–1619.

Stanton-Salazar, R. D. (1997). A social capital framework for understanding the socialization of racial minority children and youth. *Harvard Educational Review, 67*, 1–40.

Starobin, S. S., Laanan, F. S., & Burger, C. J. (2010). Role of community colleges: Broadening participation among women and minorities in STEM. *Journal of Women and Minorities in Science and Engineering, 16*(1), 1–5.

Starobin, S. S., Schenk, T. Jr., Laanan, F. S., Rethwisch, D., & Moeller, D. (2012). *Going and passing through community colleges: Examining the effectiveness of Project Lead the Way in STEM pathways.* Ames, IA: Office of Community College Research and Policy, Iowa State University.

Stevens, J. P. (2001). *Applied multivariate statistics for the social sciences* (4th ed.). Florence, KY: Psychology Press.

Strange, M., Johnson, J., Showalter, D., & Klein, R. (2012). *Why rural matters 2011–2012: The condition of rural education in the 50 states.* Rural School and Community Trust Policy Program. Retrieved from http://www.nwp.org/cs/public/print /resource/3771

Suarez, A. L. (2003). Forward transfer: Strengthening the educational pipeline for Latino community college students. *Community College Journal of Research and Practice, 27,* 95–117.

Tierney, W. G. (1992). *Official encouragement, institutional discouragement: Minorities in academe—The Native American experience.* Norwood, NJ: Ablex.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research, 45*(1), 89–125.

Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL: University of Chicago Press.

Tinto, V. (2012). *Completing college: Rethinking institutional action.* Chicago, IL: University of Chicago Press.

Titus, M. (2000, May). *The financing of success in higher education: Student aid, expectations, and the persistence of first-time, full-time freshman.* Paper presented at the Association for Institutional Research, Cincinnati, OH.

Torres, V. (2006). A mixed method study testing data-model fit of a retention model for Latino/a students at urban universities. *Journal of College Student Development, 47*(3), 299–318.

Trent, W. T., Lee, H. S., & Owens-Nicholson, D. (2006). Perceptions of financial aid among students of color examining the role(s) of self-concept, locus of control and expectations. *American Behavioral Scientist, 49*(12), 1739–1759.

U.S. Department of Education. (2011). *Iowa's wake-up call: Remarks by U.S. Secretary of Education Arne Duncan to the Iowa education summit.* Retrieved from http://www.ed.gov/news/speeches/iowas-wake-call

Urdan, T. C. (2010). *Statistics in plain English.* New York, NY: Taylor and Francis Group.

Volkwein, J. F., Szelest, B. P., Cabrera, A. R., & Napierski-Prancl, M. R. (1998). Factors associated with student loan default among different racial and ethnic groups. *Journal of Higher Education, 69*(2), 206–237.

Voorhees, R. A. (1985). Financial aid and persistence: Do the federal campus-based aid programs make a difference? *Journal of Student Financial Aid, 15,* 21–30.

Walker, J. T., & Maddan, S. (2009). *Statistics in criminology and criminal justice.* Burlington, MA: Jones & Bartlett Learning. Retrieved from http://www.jblearning .com/samples/0763755486/55485_CH14_Walker.pdf

Washington Higher Education Coordinating Board. (2010). *2009–10 tuition and fee rates: A national comparison*. Retrieved from http://www.wsac.wa.gov/sites/default/files /TuitionandFees2009-10Report-Final.pdf#search="2009â€“2010 tuition and fee rates"

Wells, R. (2008). The effects of social and cultural capital on student persistence: Are community colleges more meritocratic? *Community College Review*, *36*(1), 25–46.

Whalen, D. F., & Shelley, M. C. (2010). Academic Success for STEM and non-STEM majors. *Journal of STEM Education: Innovations and research*, *11*(1), 45–60.

White House. (2009). President Obama launches "Educate to Innovate" campaign for excellence in science, technology, engineering, and math (STEM) education. Retrieved from http://www.whitehouse.gov/the-press-office/president-obama-launches-educate-innovate-campaign-excellence-science-technology-en

Wohlgemuth, D., Whalen, D., Sullivan, J., Nading, C., Shelley, M., & Wang, Y. (2007). Financial, academic, and environmental influences on the retention and graduation of students. *Journal of College Student Retention: Research, Theory and Practice*, *8*(4), 457-475.

Yazedjian, A., Toews, M. L., & Navarro, A. (2009). Exploring parental factors, adjustment, and academic achievement among White and Hispanic college students. *Journal of College Student Development, 50*(4), 458–467. doi:10.1353/csd.0.0080.

Zarate, M. E., & Pachon, H. P. (2006). *Perceptions of college financial aid among California Latino youth.* Los Angeles, CA: Tomas Rivera Policy Institute, University of Southern California School of Policy, Planning & Development.

Zeidenberg, M., Jenkins, D., & Calcagno, J. C. (2007). *Do student success courses actually help community college students succeed?* New York, NY: Community College Research Center, Teachers College, Columbia University. Retrieved from http://ccrc.tc.columbia.edu/publications/student-success-courses-help.html