THE USE OF NON-COGNITIVES AND LEARNING STRATEGIES AS A PREDICTOR FOR COMPLETION OF DEVELOPMENTAL MATHEMATICS AT A COMMUNITY COLLEGE

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ABSTRACT

THE USE OF NON-COGNITIVES AND LEARNING STRATEGIES AS A PREDICTOR FOR COMPLETION OF DEVELOPMENTAL MATHEMATICS AT A COMMUNITY COLLEGE

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With a large global, national, state, and local drive for post-secondary credentials, higher education institutes are exploring new retention and graduation strategies to meet the needs of the employers and employees. Many students who are unprepared for college level work will enter a community college to take developmental courses. Developmental mathematics has been a large barrier to completion and success in community college.

The purpose of this study was to explore the ability of non-cognitive traits to predict persistence in completion of a developmental math sequence at a community college. Non-cognitive traits were identified from the three components of strategic learning found in the Learning and Study Strategy Inventory (LASSI): (a) the skill component (information processing, selecting main ideas and test strategies), b) the will of the student component (attitude, motivation and anxiety), and (c) the self-regulation component (concentration, time management, self-testing and study aids).

A logistical regression showed the strength of correlation to predict the success of students at a community college. Such factors that were significant in predicting success were age, Pell Grant status, three individual LASSI questions, motivation subscale,

testing strategies subscale, and when combined testing and concentration. Even though weak as individual predictors, the use of multiple variables strengthens the prediction.

With an open door policy, colleges need to identify students that are in danger of attrition and provide additional support that will increase the likelihood of their success. Along with prior academic background and demographics, non-cognitive variables and learning strategies can only strengthen predictability of risk of student attrition. With this knowledge, proper and timely intervention strategies can be used to support student success. This research challenges community colleges to target all problem areas in its approach to identify high risk students.

This dissertation is dedicated to my family who has supported me through my many years of academic achievement.

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Completing this research study would not have been accomplished without the support of the members of my doctoral committee who guided me through the steps needed for completion. Dr. Myran, the chair of the committee, was very supportive of the research and was always excited to see what the outcomes were. Dr. Williams made many phone calls with great feedback and encouraging words to keep me on track to my goals. Dr. Harder kept checking in with me about my progress of completion of this dissertation.

I would like to thank PHCC for all the support that was given towards me in completing this degree. Carolyn Byrd, a mentor and friend, inspired me to look at developmental education as the number one important issue for college completion and life success. Her innovation and attitude made each day exciting. Bronte Miller, who is my example of the perfect developmental math professor, has inspired me to take on the research and role I am currently in today. I also want to thank Kevin Shropshire for helping me with my data set and for the hours of data discussions we would have.

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Chapter I: Problem Statement

According to recent data, the ranking of American high school students' mathematical aptitude has declined over the last ten years (OECD, 2009). Currently, students are globally outperformed by eleven other countries (Mullis, 2008). With modern society becoming more technological and data driven, high level math skills are needed to perform successfully at any job. The future looks questionable because the average American lacks the quantitative competencies needed to contend with robust worldwide competition. The weak mathematical foundation built in secondary schools impedes global economic success of the country.

In July 2009, President Barack Obama set a goal to increase the post-secondary graduation rate by five million new graduates in the US by 2020 (Obama, 2009). This American Graduation Initiative will increase federal funding to community colleges to create an expert workforce. "Time and again, when we have placed our bet for the future on education, we have prospered as a result -- by tapping the incredible innovative and generative potential of a skilled American workforce," said President Obama (2009). As a result of the Obama Administration's initiative, it is likely that more people, particularly those from groups historically under-served by higher education will seek a college degree at the community college. Recent trends indicate that many of these students will not be fully prepared for college-level academic work (Bailey, 2009).

The community college's mission is to provide comprehensive higher education and workforce services that are financially and geographically accessible and meet individual needs of the community and the world (AACC, 2009). The community college is a distinct American institution, defined by open admissions, a noncompetitive, student-focused environment, and a mission of promoting students from basic skills to job readiness to associate's degrees, to transfer to pursue advanced degrees (Mellow & Heelan, 2008). The unique innovation of open enrollment creates enormous opportunities that would otherwise not exist, but it also creates challenges. Over half of all students enrolled in undergraduate higher education for the first time attend one of the many community colleges around the United States (Phillippe & Patton, 2000).

Background to Study

Developmental Education. As a result of economic conditions and the Obama initiative, enrollment in higher education and community colleges in particular, has increased significantly. With an open access policy, students of all academic abilities may attend classes at community colleges. Students who do not meet academic requirements for traditional college classes may enroll in developmental or remedial classes to improve academic skills to be successful in college.

Casazza (1999) stated that the National Center for Developmental Education's (NADE) definition of developmental education is:

> A comprehensive process which focuses on the intellectual, social and emotional growth and development of all learners. Developmental education includes, but is not limited to, tutoring, personal and career counseling, academic advisement and coursework. Developmental education is a field of practice and research with a theoretical foundation in developmental psychology and learning theory. It promotes the cognitive and affective growth of all learners, at all levels of the learning continuum. It is sensitive and responsive to the individual differences and special needs among learners. (p. 3)

According to Attwell, Lavin, Domina and Levey (2006), the National Educational Longitudinal Study (NELS) discovered 58% of traditional college-aged students in 2000 attending a community college registered in at least one remedial course. Forty-four percent of the subjects studied were required to take between one and three developmental courses while 14% took more than three courses. Colleges with high minority students or Pell grant recipients had even higher numbers of students placing into at least one developmental class (Bailey, 2009). With limited research on developmental studies, Bailey (2009) concluded that two-thirds or more of community college students possess weak academic abilities in at least one major subject area to threaten their success in college on-level courses. In Fall 2000, 97 percent of two-year colleges offered developmental courses in mathematics (Parsad & Lewis, 2003).

The National Center for Education Statistics has performed longitudinal studies to evaluate what student characteristics are more common in developmental classes (NCES, 2007). Sixty-three percent of students placed in the lower quintile socioeconomic class compared to 23% of higher socioeconomic students require a developmental class. African Americans, returning students, and nontraditional aged and dislocated workers are more likely to be enrolled into remedial classes.

Developmental Mathematics. With quantitative reasoning as a necessary life skill, mathematics courses at all levels have become a barrier for completing post-secondary education. Math aptitude and high school math course completion can predict a student's enrollment and persistence at any college (Horn & Nunez, 2000; Schoenfeld, 2002). Math has been a roadblock for many community college students with a calculated 30% pass rate to on-level math classes. Only 23% of students who enroll in a developmental class will graduate and out of that group only 14% will transfer to a four year college (Attewell, Lavin, Dominia, & Levey, 2006).

Non-cognitive elements of developmental students. Low academic ability and a lack of background in mathematics are two reasons students do not pass developmental math. Non-cognitive strategies involving self-regulatory behaviors, time management, and goal setting are suggested to increase motivation and efficacy and decrease math anxiety issues (Ironsmith et al., 2003; Jones & Byrnes, 2006; Pajares & Graham, 1999). Higher levels of self-regulation have been positively correlated with math achievment (Jones & Byrnes, 2006, Pajares & Graham, 1999). Other non-cognitive factors that can contribute to poor performance in college classes include attitude, instructional techniques of instructor, environment and learning strategies. A learning strategy is any thought, belief, or emotion that aids in the acquisition, understanding and transfer of knowledge (Weinstein, Husman & Dierking, 2000).

Because non-cognitive factors can attribute to attrition of developmental students, standardized tests are used to assist students in looking for personal weaknesses. The Learning Assessment and Study Skills Instrument (LASSI) is composed of ten subscales that allow a student to self-report on his or her thoughts, behaviors and attitudes related to strategic learning (Weinstein & Palmer, 2002). The 80 question test breaks up the ten subscales into three components which include: skill, will and self-regulation. The skill component measures thought process, test preparation and information processing. The will component is characterized by anxiety, interest in learning, self-discipline and academic dilligence. The last component, self-regulation, contains questions that relate to time management, concentration, study aids and self-testing (Weinstein & Palmer, 2002).

Purpose Statement

The purpose of this study was to explore the ability of non-cognitive traits to predict persistence in completion of a developmental math sequence at a community college. Non-cognitive traits were identified from the three components of strategic learning found in the Learning and Study Strategy Inventory (LASSI): (a) the skill component (information processing, selecting main ideas and test strategies), b) the will of the student component (attitude, motivation and anxiety), and (c) the self-regulation component (concentration, time management, self-testing and study aids). A multiple regression analysis was used to find the best possible weighting of the LASSI components to yield a maximum correlation with completion of developmental math.

The following research questions guided the study:

1. To what extent can the LASSI test predict the persistence of developmental math students in community colleges?
2. Which non-cognitive component examined in the LASSI test is most likely to predict a student's completion of a developmental math sequence in community college?

Significance

According to Drew (1996), math may be the single most important predictor related to success in college and beyond. Many entry level careers require a basic understanding of math, and math is imperative for existing and emerging jobs in a global, information and technology-based economy (Bureau of Labor Statistics, 2008; Drew, 1996). Millions of jobs, including most of the lucrative jobs, require some type of mathematical skill (Saffer, 1999). Additionally, math is used daily in personal money management and finances.

Multiple retention strategies are needed to assist the success of developmental students and on-level math students. Pascarella and Terenzini (2005) found that developmental students are more successful when a variety of retention strategies are used at a community college. Such strategies include advising, counseling, interactive teaching strategies, and comprehensive support services. A combination of strategies had a significantly more positive result than individual, isolated strategies. When working with developmental students, retention strategies are needed to increase graduation and transfer rates at community colleges. Since developmental math can be a major barrier to student success, new strategies need to be implemented. Because of the large barrier of developmental math, new strategies need to be implemented for success.

Community college students' academic performance is influenced by both academic and nonacademic variables. Bloom (1976) estimated that as much as 25% of a student's performance is determined by personal affective characteristics. Performance in mathematics almost has as much to do with students' attitudes and beliefs than with prior mathematical knowledge (Nolting, 2007). This conclusion challenges community colleges to target all problem areas in its approach to identify high risk students. With an open door policy, colleges need to identify students that are in danger of attrition and provide additional support that will increase the likelihood of their success. The use of multiple measures of nonacademic variables needs to be included in a full student assessment. Along with prior academic background and demographics, non-cognitive variables can only strengthen predictability of risk of student attrition. With this knowledge early on in a student's enrollment, proper intervention strategies can be used to assist in the student's success.

Collecting the different non-cognitive variables from the LASSI will assist developmental educators, advisors, and administrators. By using the regression model formulated from this study, a risk score based on non-cognitives and basic demographics can help with placement of a developmental student. Many schools have accelerated models or learning communities for developmental math. The risk score would help an advisor recommend the proper instructor or class structure for at-risk individuals.

On a national and state level, community colleges are compared or possibly funded based on completion, graduation and transfer rates. Because developmental students are the highest risk for failure, schools have either embraced this growth in underprepared students or have created cutoff scores for admittance into the school. With recent decrease in funding in state appropriations to higher education, institutional leaders face financial and ethical dilemmas on where to spend money. Should more money be used for a population that might not succeed, or should it be used for students who will increase the performance scores of the schools?

Nationally, the pressure on community colleges to increase the number of graduates is growing. The developmental education programs which serve most entering students are being scrutinized by federal and state elected officials. Legislators and the general public are upset over the perception that they are paying twice for the same education (Ignash, 1997). Overall, the developmental students have added a hardship to the nation's budget. Strong American Schools (2008) estimates that 1.3 million students are in a remedial class which adds up between $2.3 billion to $2.9 billion a year.

Remedial education costs the state an average of $2,000 for a community college student and $2,500 for a four year student. In the 1990's, legislators reduced remedial classes to please the taxpayers, basing these decisions on the premise that many remedial students never complete a degree (Russell, 2008).

On a global level, a more competitive workforce is needed to keep jobs in the US. Academic and technical skills are a must when advancing industries. Quantitative skills will even become more important in every industry with the advancements of technology and computer science. Mathematical reasoning skills are seen everywhere from finances, medical records, politics, current events and social policy.

This study differs from other studies because of the number of subjects in this data set as well as the availability of multiple variables that are not accessible to many community colleges. Student non-cognitives have been studied at community colleges but not quantitatively or with the use of a standardized instrument. The findings of this study will increase predictability of a student's success by analyzing cognitive and non-cognitive aspects.

Methodology

The purpose of this study was to explore the ability of non-cognitive traits to predict persistence in completion of a developmental math sequence at a community college and further education. The research questions guided the methods and procedure for collecting, analyzing and interpreting data. The research questions were directed to an association study whose aim was to discover scale and direction of interrelations among study variables. Quantitative data collection methods were used.

This study was an ex post facto design with a data set containing first time degree seeking students at a medium sized rural college in Virginia. These data contain 1048 students from 2008 to 2011 that enrolled into at least one developmental math class. Four different levels of mathematics classes, arithmetic, pre-algebra, algebra 1 and algebra 2 were included. Not all developmental math classes were required by each certificate and degree program, so a required math sequence was one to four classes. Placement tests were used to evaluation a student's mathematical aptitude for proper placement in a math class.

The data were imported in Statistical Package for Social Science (SPSS) from the Achieving the Dream and Developmental Education Initiative data sets. Students were identified by their assigned student number that can be matched with People Soft SIS system that is used for record keeping and enrollment at the community college. Each set of data was password protected and could only be accessed by certain administrators and data team members. Along with basic demographic data, LASSI and Compass scores were entered into the People Soft System and were added to the data set for this study. The Compass test was a computer-adaptive college placement test which assisted community colleges to evaluate incoming students' skill levels in reading, writing, math, and English as a second language.

Descriptive statistics and frequency distributions were used to evaluate the data to make sure this study represented the student population at the researched institution. The data were analyzed using correlation matrices, and logistical regressions between LASSI scores, basic student demographics and completion of developmental math. Multiple regression analyses were conducted to study collective and separate effects of the variables. Statistical significance was determined by p value of 0.05 or less.

Limitations and Delimitations

The findings and validity of this study were limited to the institution involved in this research and may not be generalized to other community colleges. The scope of this study was limited to first time degree seeking students who enrolled into the community college Fall 2008 through Fall 2011. This narrow focus on these students excluded returning students, continuing students and reverse transfer students. Because this was an ex post facto study, the data already existed and new data cannot be collected.

This study was also limited to the developmental math students who took the LASSI test in the first year of enrollment. Students who took the LASSI after completion of the developmental math sequence were excluded. Because of the multiple characteristics of the students, not all variables can be controlled to look directly at the LASSI scores as a predictor of success. This study was based on the assumptions that the data provided by grant data set was accurate. It was also assumed that the selected population was representative of all the first time degree seeking students at the community college.

Definitions of Key Terms

Clarification of key terms is important in fully understanding this study. Many words used in this study can have more than one definition or be used in different contexts in other research. The following words are important in the overall comprehension and design of this study.

A *community college* is a distinct American institution, defined by open admissions, a noncompetitive, student-focused environment, and a mission of promoting students from basic skills to job readiness to associate's degrees, to transfer to pursue advanced degrees (Mellow & Heelan, 2008).

The COMPASS test is a computer-adaptive college placement test which assists community colleges to evaluate incoming students' skill levels in Reading, Writing Skills, Writing Essay, Math, and English as a Second Language.

Developmental education is a field of practice and research with a theoretical foundation in developmental psychology and learning theory. It promotes the cognitive and affective growth of all learners, at all levels of the learning continuum. It is sensitive and responsive to the individual differences and special needs among learners. (Casazza, 1999).

The *Learning Assessment and Study Skills Instrument* (LASSI) is composed of ten subscales that allow a student to self-report on his or her thoughts, behaviors and attitudes related to strategic learning (Weinstein & Palmer, 2002).

A *learning strategy* is any thought, belief, or emotion that aids in the acquisition, understanding and transfer of knowledge (Weinstein, Husman & Dierking, 2000).

Non-cognitive strategies involving self-regulatory behaviors, time management, and goal setting are suggested to increase motivation, efficacy and math anxiety issues (Ironsmith et al., 2003; Jones & Byrnes, 2006; Pajares & Grahm, 1999).

Self-regulation contains questions that relate to time management, concentration, study aids and self-testing(Weinstein & Palmer, 2002).

The *skill* component measures thought process, test preparation and information processing. (Weinstein & Palmer, 2002).

The *will* component is characterized by anxiety, interest in learning, self-discipline and academic dilligence. (Weinstein & Palmer, 2002).

The remainder of the study is organized into five chapters, a list of references, and appendices in the following manner: Chapter Two presents a review of professional literature dealing with developmental mathematical education, placement scores, mathematical sequencing, instrumentation and non-cognitive attributes. Chapter three delineates the research design and the methodology of the study. The discussion and findings is presented in Chapter Four. Lastly, Chapter Five contains the summary, conclusions, and recommendations of the study. This study concludes with a list of references and related appendices.

Chapter II: Literature Review

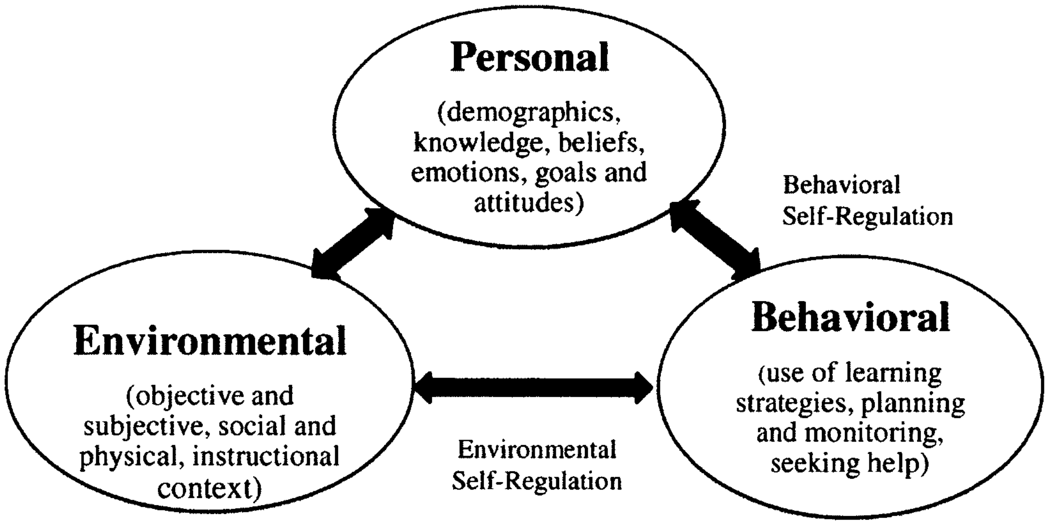
The focus of this literature review was to introduce the research on developmental education programs and persistence. This review covers four main areas. The first area discusses the social cognitive theory which provides a theoretical framework on students' behaviors, personal influences and environment in developmental mathematics. The second area discusses the traits of a community college student and the different barriers that can contribute to a student not performing well or completing a developmental math sequence. Lastly, the third section of the literature review discusses the instrument in the study, as well as the relevance of the subscales to persistence in developmental math. This study's research questions were developed to fill the gaps of research on developmental mathematics education.

The terms community college, developmental, persistence, LASSI, student, non-cognitives and mathematics were used during the literature search. Advanced searches were used with a combination of the words above as well as more specific words such as social cognitive theory and persistence in developmental mathematics. With the exception of a couple of textbooks and other books, most journal articles were found online through computerized data sets. The most common research data sets used were WilsonWeb, EBSCOhost, Sage, Google Scholar and ProQuest.

Self-Regulatory Learning Theory

The social cognitive model of self-regulated learning includes many self-processes such as metacognition, affects, and motivational beliefs such as self-efficacy and behaviors that assist in a student's learning process (Zimmerman, 1989). Zimmerman used the basis of the social cognitive theory to form a triadic model which included self-processes, behavioral influence and environmental influences (Zimmerman, 2000). Figure 1 below shows the relationship between these three components.

Figure 1. *Three components of Self-Regulated Learning Model (Zimmerman, 2000)*



The first grouping involves personal characteristics which include factors such as achievement goals, self-efficacy, metacognition and affects. Self-processes relate to the social cognitive model with variables including cognitive, affective and motivational factors. With these cognitive influences, students set goals which include acquiring knowledge or new skill, completing a class or degree and obtaining good grades (Zimmerman & Martinez-Pons, 1992). Many learning strategies are influenced by this group with affective outcomes such as anxiety, excitement, nervousness and depression. The most crucial personal characteristic is motivation, also referred as self-efficacy (Bandura, 1997). Self-efficacy, beliefs of personal attainment in a particular task, affects learning activities by level of effort expended and are integrated in the self-regulated learning theory (Bandura, 1997; Schunk, 1994).

The personal characteristics node strongly relates to the will component of the LASSI. The subscales of the will component are motivation, attitude and anxiety. . Integration of these models will help answer the proposed research questions.

The second component of the self –regulated learning theory relates to behavior of the student. These behavior processes include self-monitoring, self-judgment and self-reaction (Schunk, 1989; Zimmerman, 2002). In this category, a student assesses his or her own behavior, sets goals, and then evaluates his or her progress in learning. This component interrelates to the first component because achievement of goals can change personal characteristic such as motivation, anxiety and attitude. This behavior component relates to the LASSI with the skill component which includes information processing, selecting main ideas and test strategies.

The environmental component to the self-regulated learning theory covers extrinsic factors that can influence learning. Examples can include instruction, student support, college social and physical infrastructure and curriculum. A good learning environment supports students by eliminating barriers to learning and provides tools and instruments to increase learning success. The environment can affect behaviors and personal characteristics by the level of support at an institution. The self-regulation subgroup of the LASSI fits with this component of the self-regulated learning model.

In summary, personal characteristics, behavior, and environment components of the self-regulated learning theory relate to the three components studied using the LASSI. This model will be used in understanding the groupings of the LASSI components and looking at overall strength of student learning. The knowledge of student learning can help predict persistence for low academic abilities and can potentially create interventions to improve completion in developmental mathematics at a community college.

The Community College

Four out of five Americans will need some type of post-secondary education. The majority of these students will enter into a community college to achieve personal and academic goals (McCabe, 2003). The community college's mission is to provide comprehensive higher education and workforce services that are financially and geographically accessible and meet individual needs of the community and the world. Over half of all students enrolled in undergraduate higher education for the first time attend one of the many community colleges around the United States (Phillippe & Patton, 2000). Community colleges promote personal and academic success through noncredit classes, certificates and associate degrees (Gooden & Matus-Grossman, 2002).

Over the years, community colleges have grown to be a staple in higher education. From the opening of the first community college in 1901, over 100 million people have attended a community college. Currently there are 1, 167 community colleges in the United States (AACC, 2011). Community colleges enroll over 6.2 million students, or 35 percent of all post-secondary students (Provasnik & Planty, 2008). The student demographics have changed from an unemployed worker during the depression to a student looking to transfer to a four- year institution. Diversity has increased from the average white male to all spectrums of age, race, and gender compared to other higher education institutions (Horn & Nevill, 2006). The transforming community college creates a challenge for faculty and administrators to evolve with the changes in student population and goals.

Many students entering community college are interested in obtaining a specific occupational credential such as nursing, welding, automotive technician or graphic design (Cohen & Brawer, 2008; Voorhees, 2001). Many of the applied science and workforce students consider these degrees terminal and do not wish to persist to a certificate, associate's degree or transfer (Bailey, Alfonso, et al 2004; Horn, Nevill & Griffith, 2006). Community colleges also are local workforce development sites to improve skills at nearby industrial and business sites. Businesses realize workforce changes that require high skills and work with community colleges to provide new training for employees in that particular industry (Bailey, 2006; Voorhees, 2001).

Community colleges also provide continuing education which includes non-credit classes for personal growth rather than for academic or vocational improvement. This creates an environment with multiple missions to meet the needs of each individual in a community. Other interests of the community college are adult basic education course, English as a Second language, literacy, recreation and leisure, and correctional education (Cohen & Brawer, 2008).

The community college student. The community college's mission is preparing students for transfer to four-year institutions, vocational education, contract education for local employers, remediation of basic skills, and community services (Gooden & Matus-Grossman, 2002; Wattenbarger & Albertson, 2004). Along with the multifaceted areas of the community college, the diversity of the students promotes a new learning experience to all students. Tinto (1993) suggested that students bring different backgrounds such as socioeconomic class, academic preparation, and unique qualities that contribute to the overall learning of all students. In 2008, students older than 24 made up 51% of the community college student population (NCES, 2009). The overall age of students is decreasing because of the increase in high schools now teaming with community colleges and the need for general studies that transfers credits to four year institutions. Females, minorities and part time students are the majority of students today in community colleges (Horn & Nevill, 2006).

Over 70 percent of public high school graduates enter into an institution of higher education within two years of graduation (Kirst & Bracco, 2004). Over 50% of those students will take remedial courses and 41 percent will not complete a two or four year degree (Kirst & Bracco, 2004; Thompson, 2006). Only about one-fifth of community college students are "traditional aged" students (Bailey, 2006). Traditional aged typically means that students enter community college right after high school and are enrolled before the age of 25. Many students may be a traditional age but have different issues such as are full-time employment and single mothers that make them less traditional. Komives and Woodward (2003) believed using age for traditional and nontraditional terminology may not be accurate. The average age of a student entering a community college is 29 (AACC, 2009). Students tend to delay admission into community college directly from high school and are more likely to enroll part-time than full-time (Bailey, Alfonso, et al, 2004).

The gender split in community college is 60 percent women and 40 percent men but varies widely by specific programs (Bailey, 2006). Minorities make up 35 percent of the population but this number is growing fast (Horn, Nevill, & Griffith, 2006). The fastest growing population at community colleges is Hispanics even though this minority group is the lease represented in participation and completion (Bailey, 2006). The

American Association of Community Colleges (2008) reported that 39 percent of students entering community college are first-generation college students.

Developmental Education

Annually more than one million students who enter higher education are not college ready (McCabe, 2000). Because of the open admissions policy in 95 percent of community colleges, students of all academic levels are admitted into various programs (Provasnik & Planty, 2008). Admission to a community college does not signify a student may enroll in any class he or she chooses. Academically underprepared students may take credit courses when they demonstrate a level of proficiency in those subjects or have completed a developmental course as a prerequisite.

Over the last couple of centuries, developmental education has been called many names such as preparatory studies, compensatory education, corrective education, remedial education, and basic skills (Farakish, 2008). Developmental education as it is now began with the start of land-grant colleges that accepted students not prepared for college coursework (Merisotis & Phipps, 2000). With the increase of financial difficulties and competition between new colleges, many institutions increased enrollment with developmental students (Casazza & Silverman, 1996). The change in thought from college becoming a right and not a privilege increased developmental education offerings at many schools.

Casazza (1999) stated that the National Center for Developmental Education's (NADE) definition of developmental education is:

> A comprehensive process which focuses on the intellectual, social and emotional growth and development of all learners. Developmental education includes, but is

> not limited to, tutoring, personal and career counseling, academic advisement and coursework. Developmental education is a field of practice and research with a theoretical foundation in developmental psychology and learning theory. It promotes the cognitive and affective growth of all learners, at all levels of the learning continuum. It is sensitive and responsive to the individual differences and special needs among learners (p. 3).

Developmental education exists in different forms across colleges campuses with a variety of requirements and services. Developmental classes do not count towards a particular degree and are noncredit courses. Most of these courses are designed to aid academically underprepared students in reading, writing and mathematics. These offered courses can be centralized in one department or separated under English and mathematics departments (Shults, 2000). Students in a centralized program were more likely to complete all developmental education requirements than students in a decentralized program (Boylan, Bonham, Claxton et al., 1992). Delivery methods of developmental courses vary. These formats can include self-standing courses, supplemental instruction, pre-college bridge programs, and learning communities (Cohen & Brawer, 2003).

Developmental education is hard to assess. Research on developmental education has improved over the last couple of years but is still inconclusive on the effectiveness of these programs. The students are underprepared before they come into a college setting giving them a disadvantage for graduation. These students are compared to credit level students at the start. Contradictions occur because of lack of criteria for placement, use of various assessment tools, exiting procedures and overall requirements for each institution. Research has been performed in states such as Ohio and Indiana who do not have state policies on placement of students. Developmental students have multiple academic and personal variables that can lead to success or failure that might not relate to work done in a developmental course (Bettinger & Long, 2005).

Many reasons are stemmed from why a student enters a developmental program and is underprepared for college courses. Some researchers think that the inadequate preparation in high schools and rigor do not align with college curricula (Aldeman, 1999; Hoyt & Sorenson, 2001). First generation, low income and ethnic minorities are more likely to be underprepared and not to have access to preparatory courses in high school (Hearn & Holdsworth, 2004;Venezia et al, 2003).

Some research has shown that students who take developmental classes do not perform better than students who are recommended to take the developmental class but opt to move straight into the on-level course. Calcagno and Long's (2008) research contradicted NCES research and found assignment to remediation had a statistically significant negative effect on completion of an associate's degree, transfer, completion of the first college-level course and total non-remedial credits earned. This research has not been duplicated. This data has been inconclusive due to poor methodologies and assessments. Research on placement test scores and success in a developmental or on-level course has never shown a strong significant correlation.

Developmental education student. More and more students are entering community college while more and more are academically underprepared (ACT, 2008; McCabe, 2000; Venezia, Kirst & Antonio, 2004). According to Attwell, Lavin, Domina and Levey (2006), the National Educational Longitudinal Study (NELS) researched traditional college-aged students in 2000 and found 58 percent of students attending a community college took at least one remedial course, 44 percent were required to take between one and three developmental courses while 14 percent took more than three courses. Colleges with high minority students or Pell grant recipients had even higher numbers of students placing into at least one developmental class (Bailey, 2009). Some states do not require assessment tests before entering community college, so the need for remediation is not addressed. With the limited research on developmental studies, Bailey (2009) concludes that two-thirds or more of community college students possess weak academic abilities in at least one major subject area to threaten their success in college-level courses.

The National Center for Education Statistics (NCES, 2002) has performed longitudinal studies to evaluate what student characteristics are more common in remedial classes. Sixty-three percent of lowest socioeconomic class students are placed in developmental classes compared to 23 percent of higher socioeconomic status students requiring a developmental class. African Americans are more likely to test into a developmental class. Returning students and dislocated workers that are older than traditional age are more likely to be placed into remedial classes.

According to the NELS, 68 percent of students completed the developmental writing sequence while 71 percent passed all the reading courses (Attewell, Lavin, Dominia, & Levey, 2006). Math has been a roadblock for many students with a calculated 30 percent pass rate to on-level math classes. If 30 percent of students never make it to college math, the likelihood of the student graduating with a degree, certificate or diploma is unlikely. Twenty- three percent of students who enroll in at least one developmental class graduate with 14 percent transfer compared to 40 percent of students complete a degree that tested into on-level with the same 14 percent transfer (Attewell, Lavin, Dominia, & Levey, 2006).

Many recommendations have been made to developmental education departments. Roueche and Roueche (1999) called for strengthening developmental education departments by taking these certain measures: mandatory placement based on assessment, having developmental prerequisites, systematic evaluation of remedial programs, institutional monetary commitment, increased support services and advising for at risk students, student orientation, attendance policies, best faculty and innovative curriculum. Improvement has been made in the last decade to increase services and research on developmental education programs.

Who should provide developmental education? As budgets decreased, many parties involved in education are pointing fingers. The community college's mission has grown over the years to adapt to the change in education. Many community colleges spend more time and money on remedial education which affects other technical and transfer programs. Four year universities consider remedial education as below college level and will not lower their standards for these students. High schools have complained that they have crowded classrooms, poorly funded schools and state academic standards that need to be met.

For years, legislators have debated where the money should go for remediation. Legislators and the general public are upset over the perception that they are paying twice for the same education (Ignash, 1997). Overall, the remedial students have added a hardship to the nation's budget. Strong American Schools (2008) estimates that 1.3 million students are in a remedial class which adds up between $2.3 billion to $2.9 billion a year. The average cost for a community college student for remediation at the state level is $2,000. In the 1990's, legislators cut back remedial classes to please the taxpayers. These decisions were made on the fact that many remedial students never complete a degree so why waste money on them (Russell, 2008).

Many four year institutions are discouraged to teach any remedial classes. Twenty-two states and college systems have reduced or eliminated remedial classes at four year colleges and universities. System strategies included: raising admission requirements, charging extra tuition for remedial classes, restricting state funding for faculty to teach remedial classes, requiring a student a short time period to finish remedial classes, and limiting the number of classes a student may take (Russell, 2008). Because of this issue, many universities contract with a community college to assist the underprepared students. Some critics think moving developmental studies to community colleges risks the chance of a student receiving a bachelor's degree. The state will lose money because a person with a bachelor's degree is more likely to be a productive citizen that pays more taxes.

Because of unprepared students graduating high school, many states have combined the community college and K-12 system together to increase alignment with secondary and post-secondary education. The Education Commission of the States (ECS, 2011) reported that 38 states have a P-16 or P-20 council that assists states to create college ready students. Many of these councils give standardized exams in high schools for career and college readiness. Students have the option of taking developmental courses in high school before entering the community college or four year institution.

Local political problems between community colleges and high schools need to be addressed for any hope of closing the gap between the secondary and post-secondary education. High schools possess many issues that can contribute to underprepared students. Many students who receive the standard degree are only required to take two math classes. These two math classes are two courses below college level math. With overcrowded classrooms and worn out teachers, high school education has declined. An ongoing conversation about the educational possibilities in a community must be addressed.

Developmental Mathematics

While the problem of under-prepared students is wide-spread, it is more pervasive in mathematics (Boylan, & Saxon, 1999; Provasnik & Planty, 2008). In 2000, the National Center for Education Statistics determined that 76 percent of all institutions that admit freshman offer at least one remedial math class with 80 percent at four-year institutions and 98 percent at two-year institutions (Parr et al, 2006). Most colleges offer multiple levels of math with 60 percent offering three of more levels of developmental math (Boylan & Saxon, 1999). A 2007 study of Achieving the Dream Community Colleges revealed that remediation rates for students completing their highest level of mathematics in grade 12 were: Algebra 2 or equivalent 63 percent, Algebra/Trig 32 percent, Precalculus 15 percent and Calculus 3 percent (Biswas, 2007). The Lumina Foundation (2006) also studied 35 Achieving the Dream schools and found that 61 percent of students tested into developmental math while only 51 percent passed the class.

National attention has been given to developmental math because of the high withdrawal and failure rates. Around 20 percent of students' withdrawal from a math class with 30% failing (Gerlaugh, Thompson, Boylan & Davis, 2007). Aldeman (2004) found that developmental math classes had the highest withdrawal, repeat and failure rates of all college courses nationwide.

Developmental mathematics has been a large barrier for students completing a community college credential. Many reasons are found to show where the weakness in math skills begins. Because many entering students come right out of high school, the alignment between high school and community college is not always seamless (Venezia, Kirst & Antonio, 2003). Forty-two percent of high school students reported some gaps in their math skills with 13 percent reporting significant gaps (Achieve, Inc, 2005). When asked what area was the greatest weakness in high school, 30 percent of community colleges reported mathematics (Achieve, Inc., 2005). Many community college students took the minimum of two to three years of math in high school and did not take math their senior year (Conley, 2005). Other reasons for math remediation was course taking choices, state high school graduation exams, math gap phenomenon, lack of incentives and focus on high school graduation rates.

Many researchers ask if high school math curriculum lacks rigor or if placement tests are the problem. The first reason that students enter community college underprepared in math can be the limited courses required to achieve a high school diploma (Biswas, 2007; Brown & Niemi, 2007; Kirst, 2003; Smydo, 2008, Roth et al, 2001). Students try to meet the minimum GPA and course requirements which lead to not taking math their senior year (Kirst & Bracco, 2004). Forty percent of high school students bound for two-year colleges did not take the recommended courses deemed necessary for college level work (Kirst & Bracco, 2004). Students chose to take easier classes to boost their GPA and not for college readiness (Roth et al, 2001). Some states have students complete their state mathematics graduation requirement in their junior year which exempts them from math in their senior year of high school. Termed the "math gap", students do not use their math skills for a while and then forget simple concepts (Thompson, 2006). This is supported by ACT-tested students going directly into community where 57 percent tested into a developmental course (Blair, 2008; Thompson, 2006). The gap only increases when students do not enter college right after graduation which is very common in community colleges (Bailey, 2006)

One contradictory finding was that students who were placed in developmental mathematics but entered into college level math did better than their counterpart who took the developmental class (Curtis, 2002). The researcher cautioned that the placement test was never validated and the rigor of the developmental course was not evaluated to look at a student's true academic ability. These findings can lead to there are other factors that can lead to student success in mathematics.

Placement Testing

In 2003, the National Center for Educational Statistics (NCES) found that 57 to 61 percent of institutions gave all incoming students a placement test. Twenty-five to 29 percent used a selective approach by examining SAT and ACT scores for placement. Common tests such as ACUPLACER and COMPASS are used around the United States. Even though these tests are used in many states, many institutions vary in the cutoff score needed to enroll in certain developmental classes. Even though a wide variety of placement exams exist, many features are common such as the math portion with multiple levels, computerized, standardized, and importance (Ternes, 2009).

In California, 94 different assessments were used around the state (Magee, 2010). The tests varied significantly in terms of material assessed and the level of proficiency needed from the student. The lack of consistency challenged students entering the system to define college readiness and know the expectations of the college. During the 2005-2006 academic year in California, over 800,000 students were recommended to take the placement test, with 340,000 declining to take the tests (Brown & Niemi, 2007).

Test validity, reliability, and norming for these placement tests have been an issue around the country (Littleton, 2000). Empirical evidence on the effects of assessment procedures on ethnic minorities, women, and the disabled have not been studied extensively. Research on placement scores has been mixed with reviews of effectiveness. Because success is defined in many ways, research is inconclusive. Boylan, Bliss and Bonham (1997) found that mandatory placement was positively correlated to passing a particular class but slightly negative correlated to completion of a developmental sequence.

Armstrong (2000) raised the question of how a placement test does not align with course objectives. Without a formative evaluation of a student, a program could not determine a student's academic needs or abilities. The purpose of placement tests has also been questioned. Does the test compare students, predict success in a class or determine what skills the student has mastered? Drew (1996) indicates that aptitude tests tell little about what students are capable of learning. High school exit exams do not align with placement tests or college material (Brown & Niemi, 2007; Thompson, 2006).

Many high school exit exams test students on a ninth or tenth grade level which is below what is needed for on-level college mathematics.

Brothen and Wambacj (2004) have shown basing a student on one test with excluding other information not to be an effective way to place a student. Multiple measures when placing a student in addition to test scores are needed to address the overall academic and nonacademic needs of a student. Student skills, abilities, motivations and social support are also predictors of student success in addition to placement scores (Hill, 2008; Willett, Hayward, & Dahlstrom, 2008).

Calcagno (2007) studied students persistence based on the cutoff score. They discovered that students who scored just below the cutoff score and enrolled in a developmental class were more likely to persist to the second year. Students who take developmental classes are more likely to achieve more credits within a six year period than a student who does not enroll in a developmental class. Completion on college math did not show a significant change with students who completed a developmental class. Placement in a developmental class had a slightly negative significance to completion of college level coursework, degree completion and transfer to a four year university.

When students are placed in a class solely on the results of a mathematics skills test without examining other non-cognitive factors, a high number of unsatisfactory placements occur (Strong American Schools, 2008). Students who perceive being placed in a class lower than their skills are discouraged to enroll in college-level classes. (Bailey, 2009; Brown, 1999; Marwick, 2002).

Because of the importance of the test to a student's career, many schools are creating intervention programs to prepare students for the placement test. Ruiz (2007) studied one intervention strategy where 85 percent of the students were aware of the placement test and 85 percent of those students still did not prepare for the exam. These students who placed into a remedial class admitted they did not feel challenged since they were reviewing material they had learned in high school. A 2008 Achieving the Dream recommendation stressed the emphasis be placed on policies governing student assessment and placement in developmental education (Collins, 2008).

Student Persistence in the Community College

Many studies have been done to look at retention rates in community college students. The first research studying demographic factors included Astin (1973), Bean (1980), Cope and Hannah (1975) and Mallinckrodt and Sedlack (1987). After looking demographics researchers continued to add to the literature in areas of interpersonal dimensions (Allen, 1986) and attrition models (Bean, 1983; Tinto 1975). More than 60 percent of students do not complete a community college degree in five years and only half will remain in college after the first year of enrollment (McGrath, 2001)

With the earlier persistence models proposed by Tinto (1975, 1993) and Bean (1980, 1985), common factors have emerged to assist intervention and attrition predictions. The common factors include: contextual influence or institutional factors, perceived social support, social involvement and academic engagement or commitment to obtaining a degree (Robbins et al, 2004).

Sociology theory suggests that background information such as family, academic preparation and social influences need to be in every study performed on persistence (Nora, Attinasi, & Matonak, 1990). With an open door policy, students at a community college come in with diverse backgrounds and issues. Issues such as finances, child care, health, transportation, family life and general indecision can lead to a higher dropout rate in community college students. Tinto (1993) breaks down the reasoning for student departure into four areas: psychological, sociological, economical and organizational.

The first perspective on why students do not complete a degree or drop out is psychological. Motivation, need for control, self-efficacy and need for affiliation impacted psychological departure behavior (Braxton, Hirschy & McClendon, 2004). The sociological reasons for a student not persisting would be status attainment, classroom as a community, parents' education level, and anticipatory socialization (Braxton, Hirschy & McClendon, 2004). Commuter status and part-time enrollment also increased a student's likelihood of dropping out (Bean & Metzner, 1985). The student's ability to pay and cost-benefit perception influenced a student's choice in withdrawing from school (Braxton, 2003). Commitment to the organization or institution also increases retention (Tinto, 1993). Since persistence is related to perception, the overall image of the community college needs to be researched to retain students (Wild & Ebbers, 2002). Student involvement and interaction on campus and with faculty can increase retention rates and improve overall campus image (Marti, 2006).

Pre-matriculation Variables that Influence Persistence

Many variables have been a predictor of student success. Community college students have many characteristics that might compromise the ability to succeed in college (Bailey, Jenkins & Leinbach, 2005a). Looking at one of these variables in isolation will not be a good predictor of success of a student (Ishitani, 2006). The following pre-entry characteristics that affect completion rates are first generation, income, ethnicity, gender, age, enrollment status, and academic preparedness.

In 2004, Tinto reported that 42 percent of students entering post-secondary schools are first generation students. This means that neither parent has completed a bachelor's degree. These students are more likely to enroll late in college, attend closer to home, commute, attend part-time, work full-time, older, female, disabled, minority, single parent and have completed a General Educational Degree (GED) (Engle & Tinto, 2008). Parents' education levels were a significant predictor in attrition (Coppola, 1999; Fike & Fike, 2008). With a higher attrition rate, these students were 51 percent less likely to graduate (Ishitani, 2006).

Income of a student can be a predictor of success. First generation is often paired with low income because of correlation between attending school and income. Sixty-five percent of high income students earn some type of degree in two years while only 50 percent of low income students complete a degree (Tinto, 1993). Financial aid at two year colleges positively correlates to persistence (Braxton, Hirschy and McClendon, 2004). Pell grant recipients did the same if not higher than high income students at two year schools (Tinto, 1993). Occupational programs showed little difference between persistence in different socioeconomic backgrounds (Bailey, Alfonso, et al, 2004).

Because of the low cost of community colleges and the need for a post-secondary credential, more minorities are enrolling in colleges. Enrollment has grown from 20 percent in 1976 to 36.5 percent in 2004 (Cohen & Brawer, 2008). Ishitani (2006) reported that minorities are more likely to drop out of college while Fike and Fike (2008) said there was no significant difference. Black and Hispanic students were slightly higher than white students to depart from college (Berkner & Choy, 2008).

In 1978 the number of women exceeded the number of men in community colleges for the first time (Cohen & Brawer, 2008). More women receive degrees than men (NCES, 2006). Fike and Fike (2008) did not find a difference between men and women with completion but with age. Age was found to be a weak predictor of retention with older students doing better than younger students. Older students are defined as entering college for the first time at the age of 25 or older (Calcagno, Crosta, Bailey & Jenkins, 2007).

Many community college students think of themselves as workers going to school part-time (Bailey, Leinbach, Scott, et al, 2004). Because of the age and responsibilities of community college students, the average community college student works 32 hours a week (Horn, Nevil & Griffith, 2006). Part-time students are less likely to complete a degree or certificate. Only 15 percent of part-time students complete a degree versus 64 percent of full-time students (Wasley, 2007). High work load has a negative effect on completion, grade point average, cultural awareness, retention and college satisfaction (Komives & Woodward, 2003). What is not found in the literature is why students come to community colleges. Many students who enroll part-time have goals for personal improvement or workplace skills and not completion.

Roman (2007) stated admission officers need to be skillful in reaching out to at risk populations, bridging the cultural gap that may divide them, in order to encourage and educate them about the opportunities that a college education provides. Knowing who might be at high risk could help assign intervention strategies to improve retention and graduation (Hyers & Zimmerman, 2002). Persistence and completion have been studied for decades but little improvement has been seen over the years. National studies are a great baseline for research, but individual institutional studies have a direct impact on a campus (Komives & Woodward, 2003).

Importance of degree completion. Degree attainment is an important value not only to the student but the institution, state, nation and the world (Astin & Oseguera, 2005). In *Adding it Up* (2007), the decline of the United States ability to compete globally is directly connected to stagnating degree attainment levels. The decline could continue at a higher rate in the future. Once known for the lead of knowledge production around the world, other industrialized countries are emphasizing post-secondary education to have an advantage in global competition.

The student benefits greatly by completing a degree. Students gain skills that make them more employable, higher paid and contributions to the workforce (Cohen & Brawer, 2008). A person who obtains a two-year degree will net an additional $500,000 in a lifetime (Baum & Ma, 2007). With a degree, first generation students can double their previous income (Tinto, 2004).

The institution and community also gain financially when more students graduate. With state and local funds diminishing, institutions are finding it cost effective to study retention and persistence trends (Tinto, 1993). Schools are funded based on enrollment. Prevention of departure can increase enrollments, college finances and image of the school (Braxton, Hirschy & McClendon, 2004). Keeping the local workforce afloat with skilled workers is essential for economic growth in an area. Increasing the earning potential for degree completers provides tax revenue for the nation and the state (Engle & Tinto, 2008). Lower levels of education in an area are indirectly proportional to the level of crime, poverty, unemployment, and healthcare (Baum & Ma, 2007). Higher education attainment positively correlated with higher levels of volunteering, voting, donating blood and civic engagement. The generational impact of college graduates' children also being college graduates improves a community (Hill, Hoffman & Rex, 2005).

Learning and Study Strategy Inventory

The Learning and Study Strategies Inventory (LASSI) is a self-report instrument used to assess learning strategies based on a model of learning, cognition and strategic learning (Weinstein, 1994). Strategic learning is derived from cognitive psychology and is focused on students as active, self-determined individuals who process information according to their learning core: skill, will and self-regulation. Weinstein and Mayer (1986) differentiated between learning strategies that evaluate learner's information (rehearsal, elaboration and organization) and affective and metacognitive support for learning. This tool has been used in over 2000 post-secondary institutions internationally (McMahon & Luca, 2001).

By using a functional approach, ten subscales were defined and the survey questions were made by these observations from experts. This process was repeated several times and refinements were made after using coefficient alphas (Weinstein, Zimmerman & Palmer, 1988). In the user's manual, the authors report Cronbach's alphas ranging from .86 to .68. The ten subscales included: information processing, selecting main ideas and test strategies, attitude, motivation, anxiety, concentration, time management, self-testing and study aids.

The LASSI does not produce an overall score but ten subscales with a raw score and a percentile score. If a student is below the 50th percentile, that improvement is needed in that particular area. Students who score between the 50th and 75th percentile should consider improvement.

After Weinstein's initial studies, only five representative research projects have focused on the psychometric analysis of the LASSI with three studies looking at college students (Melancon, 2002; Olaussen & Bratten, 1998; Olejnick & Nist, 1992). Olejnick and Nist (1992) utilized the LASSI on first year, high achieving developmental students enrolled in the first and last quarters of the program. Data from both populations were cross-validated and the data was analyzed using factor analysis and reliability estimates. The ten subscales were grouped into three factors with the first including Motivation, Time Management and Concentration. The second consisted of Information Processing, Study Aids and Self-Testing scales. The last factor take account for Anxiety, Selecting Main Ideas and Test Strategies scales. Main Idea, Concentration and Attitude fit in multiple factors.

The findings of Oluaussen and Braten (1998) were similar to the results of the study by Olejnick and Nist (1992). These researchers studied high achieving Norwegian College students the first and second year of college. The factor analysis of subscale scores revealed a similar structure as noted before. These three factors were identified as Effort Related Activities, Goal Orientation and Cognitive Activities. Like the Olejnick and Nist study, Concentration, Selecting Main Ideas and Attitude overlapped. This model differs from the previous studies in two main aspects. Effort-Related Activities and Cognitive Activities are positively interrelated but not like the American models where Goal Orientation was positively associated.

Malancon (2002) carried out a factor analysis of the line items and not the subscales of the LASSI and identified 18 factors with eight values greater than 1.0. She concluded the LASSI did not measure the 10 scales described in the manual. Weinstein et al (1988) admitted they used experts and not factor analysis for item selection and subscale development. Some researchers believe that factor analysis alone cannot validate scales, and the conceptual clarity of group items should be maintained (Entwistle, Meyer, & Tait, 1991).

Even though the previous researchers have disagreed with the grouping of the components as the original author, some limitations exist in the research. All the previous studies used high achieving college students enrolled in a social science program in the first or second year of college. There has been very little research has been done on the latent constructs measured by the LASSI and learning.

Non-Cognitive Factors

Developmental students are among the lowest achieving students not only because of the lack of academic preparation but the lack of motivation and effort for long-term academic tasks (Bembenutty & Zimmerman, 2003; Ray, Garavalia & Gredler, 2003). These students are more likely to give up when faced with academic and personal challenges. Many factors are accredited to a student's success in developmental math classes including students' cognitive and non-cognitive traits. Cognitive traits are those related to thinking, reasoning and other intellectual abilities to be successful in a math course (Schunk & Parajes, 2002). Non-cognitive traits pertain to qualities such as persistence, dependability, responsibility, attitude, resilience, engagement and motivation (Kyllonen, 2005). Other non-cognitive traits that positively correlate with success in college include self-concept, realistic self-appraisal, goal setting, strong support, community involvement and acquired knowledge (Sedlacek, 2004). Students who have higher levels of self-regulation are better at controlling cognitive, metacognitive and behavior characteristics of learning (Zimmerman, 1998). Only seven percent of institutions assess non-cognitive factors even though research has shown that these characteristics are more likely to predict college success than previous grades and standardized test scores (Gerlaugh et al, 2007; Sedlacek, 2004).

Motivation. As defined in college context, motivation is the positive engagement in classroom tasks and study to master concepts of skills (McMillan & Forsyth, 1991). According to the LASSI, motivation is the degree to which a student accepts responsibility for their study habits, academic performance and behaviors related to school tasks (Weinstein, 1987). Motivation can come from within which is intrinsic and from external factors and environment which is termed extrinsic. Houle (1961) first studied motivation in students. He grouped subjects into three personality types: goal-oriented, activity-oriented and learning oriented. Goal-oriented students used education to accomplish definite objectives. Activity-oriented motivated students sought some type of social contact and picked activities that included some type of human relationship. Learning-oriented students were interested in gaining knowledge and personal growth. This study was the beginning of researching motivation but has been criticized for not have a diverse sample.

Boshier (1977) believed both internal, or psychological, factors as well as external, or environmental, factors contributed to participation in formal learning. Both these factors together influence motivation of a student. When studying nontraditional students, he noted that colleges needed congruence between the environment of the college and the learner's motives.

Covington (2000) and Eccles and Wingifield (2002) have researched different motivational theories in relation to college student's success. Covington divided motivation in to two subcategories: motivation based on achievement-as-drive and motivation from achieve-as-goal (2000). Together these two theories based motivation on achievement. Eccles and Wingfield (2002) found that motivational factor were predictors of a student's success. Robbins et al. (2004) agreed that motivation is a predictor of college student's academic performance above other more common predictors with a meta-analysis (2004).

Anxiety. Math anxiety and test anxiety have many similarities that can contribute to student success (Hembree, 1990). The similarities are that math and test anxiety have effects on the students' performance in a similar fashion, both constructs respond better to behavior treatments and not cognitive treatments or group counseling, differences in anxiety level regarding student ability, gender and ethnicity are similar between the two anxieties. Test anxiety has been defined as having negative emotions that have negative consequences on performance (Cassady & Johnson, 2002; Hancock, 2001).

Because of the barrier of math in post-secondary education, many methods have been studied to alleviate math anxiety (Shields, 2006; Wieschenberg, 1994). Such methods would include pedagogy, curriculum design, assessment, classroom, culture and teacher attitudes. Some recommended strategies to alleviate math and test anxiety in math would be to encourage group learning, understand individual differences in problem-solving strategies, counseling and relaxation training (Shen, 2009).

Other non-cognitive barriers are interrelated to anxiety. Pajares and Kranzler (1995) found self-efficacy had a direct correlation on anxiety which in turn had a direct effect on performance on ninth through twenty-second graders. In developmental math, poor math self-efficacy and poor attitude contributed the greatest to math anxiety (Martin, 1994; Sherman & Christian, 1999). Students who are reported to have math anxiety are more likely to avoid math, fail to complete homework and procrastinate (Ikegulu, 2000).

Attitude. Negative attitudes, toward math and learning, influence academic outcomes (Chouinard, Karsenti & Roy, 2007; Ikegulu, 2000). Attitudes of low achieving students inhibit motivation in math classes (Miller, 2000). When a student understands the material and does well, attitudes increase and so does performance. This self-regulatory strategy was a key characteristic in high achieving developmental math students (Miller, 2000). Ability was a stronger prediction of math achievement in low and high scoring groups, but attitude towards math was a better predictor in the moderate ability group (Bassarear, 1986).

Math attitude changes according to a student's perception of value of math. The perceptions are indirectly related to a student's effort exerted (Chouinard, et al, 2007). Positive attitudes toward math are inversely related to math anxiety. Only math self-concept was a predictor of math anxiety when self-concept, arithmetic skills and beliefs about math were studied (Gourgey, 1984).

Information processing. Information processing is formed from the model of memory which proposes that individuals remember material more accurately and can be processed at a deeper level (Craik & Lockhardt, 1972; Marton & Saljo, 1976). This type of processing goes beyond rote memorization and can lead to higher level of understanding. This framework includes three approaches which include: a deep approach which is driven by one's internal motivation, a surface approach which is driven by one's external motivation and the strategic approach which is determined by achievement and not for new knowledge (Biggs, Kember & Leung, 2001; Entwistle & Waterson, 1988).

Study Aids. The use of study aids can be termed in the category of metacognition and self-regulation ability (Gettinger & Seibert, 2002). Metacognition is defined as "one's knowledge concerning one's own cognitive processes and products and the active monitoring and consequential regulation of those processing in relation to the cognitive objects or data on which they bear" (Flavell, 1976, p. 232). Students active in their own learning environment usually will seek assistance from peers and teachers, possess high self-efficacy and effective time management as well are very goal-oriented and self-motivated (Ley & Young, 1998).

Time Management. Some researchers believed effort outside the classroom and less procrastination was a better predictor of academic success than participation in the classroom (Chu & Choi, 2005; Cooper, 2001). Time management includes studying, reviewing notes, reading and doing homework. Depression, lower amounts of stress, and higher of satisfaction have been correlated with perceived control of time (Chu & Choi, 2005). Macan et al (1990) found time management to be related to setting goals, planning, perceived control of time and preference for disorganization. The research studies contradict themselves with overall work hours and academic performance (Marlowe, et al, 2002; Soltz, 1992).

Conclusion

The review of the literature would indicate there is a relationship between learning and study strategies and persistence to academic success. Self-regulated learning is related to the use of particular strategies that increase completion rates. Since developmental mathematics is a large barrier to a community college student's success, more studies need to be performed to look at the relationship between non-cognitive factors in developmental mathematics students and persistence.

Chapter III: Methodology

This chapter will present the procedures and methodologies for the proposed study on non-cognitives and developmental mathematics at a community college. The purpose of this study is to explore the ability of non-cognitive traits to predict persistence in completion of a developmental math sequence at a community college. Non-cognitive traits were identified from the three components of strategic learning found in the Learning and Study Strategy Inventory (LASSI): (a) the skill component (information processing, selecting main ideas and test strategies), (b) the will of the student component (attitude, motivation and anxiety), and (c) the self-regulation component (concentration, time management, self-testing and study aids). A multiple regression analysis was used to find the best possible weighting of the LASSI components to yield a maximum correlation with completion of developmental math. The following research questions guided this study:

RQ1-To what extent can the LASSI test predict the persistence of developmental math students in community colleges?

RQ 2- Which non-cognitive component examined in the LASSI test is most likely to predict a student's completion of a developmental math sequence in community college?

Context of the Study

Site description. Data was collected for this study from Fall 2008 to Fall 2011 in a small rural community college in Virginia. Headcount averages around 3500 students with 51% full time and 49% part time students. Thirty associate degree programs, eleven certificates and 50 career studies programs were offered at this institution. One third of the school's first time degree seeking students were minorities. With 61 percent female and 48 percent of students under the age of 21, the college was a strong representative of other community colleges in the area. Currently, around 80 percent of students entering this college tested into one developmental class. Individual mathematics course completion rates were found in Table 1.

Table 1

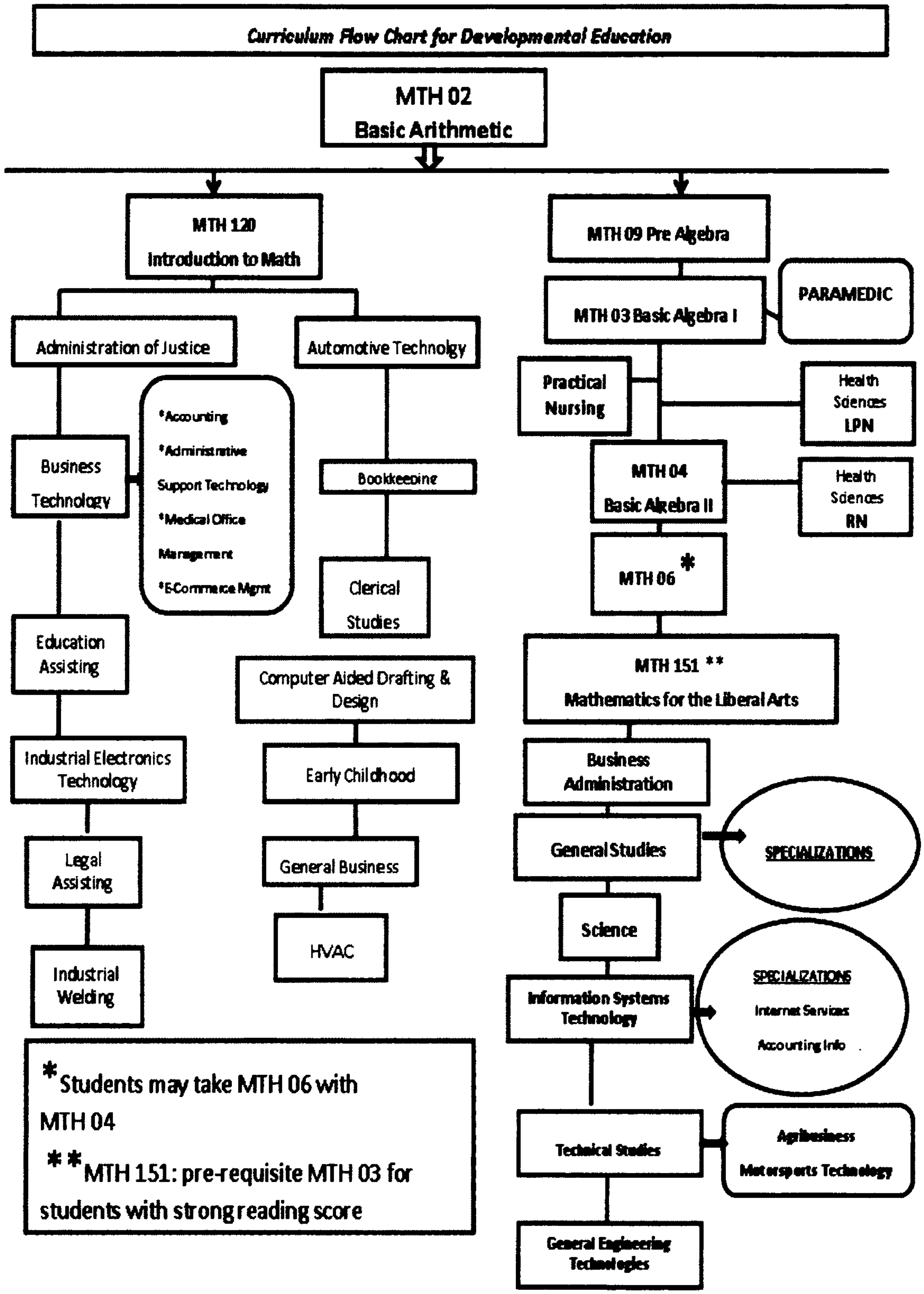
Course Pass Rates

Course Number	Course Name	Pass Rate	# of Students
MTH 02	Arithmetic	60%	144
MTH 09	Pre-Algebra	55%	123
MTH 09 FT	Pre-Algebra (Fast-Track)	67%	21
MTH 09 TOTAL	Pre-Algebra (All Sections)	57%	144
MTH 03	Algebra I	40%	166
MTH 03 FT	Algebra I (Fast-Track)	74%	34
MTH 03 TOTAL	Algebra I (All Sections)	46%	200
MTH 04	Algebra II	53%	137
MTH 04 FT	Algebra II (Fast-Track)	81%	16
MTH 04 TOTAL	Algebra II (All Sections)	56%	153
MTH 06	Developmental Geometry	70%	33
	TOTAL PASS RATE – MATH	55%	674

The data used in this study was selected from a data set that contains over 15,000 students and was recorded for various grants. The only requirement to be entered in this complete data set was that a student was a first time degree seeking student at the current school studied.

To be placed in a developmental class, the COMPASS test produced by ACT was taken by every student entering the college. The COMPASS exam tested students on basic algebra, reading and grammar and produced a score similar to a grade level placement. A student chose to take the COMPASS Algebra test if he or she was confident in math or took the COMPASS Pre-Algebra test if not sure of mathematical ability. The computerized test adjusted the level of difficulty for each question based on the answer given to the question before. Students must meet a particular cutoff score to be placed into an on-level mathematics class. Students who score below the cutoff score was entered into one of four developmental math classes: basic arithmetic, pre-algebra, algebra 1 and algebra 2. Cutoff scores were established by the studied institution for placement purposes and were not universal across the state. Because of the variety of programs at the community college, not all developmental mathematics classes were required for completion of a degree or certificate. Completion of a developmental sequence was based on the program in which the student enrolled. Figure 2 showed a flow chart for student requirements for development math completion for graduation of a certificate or degree.

Figure 2. Flow of Students in Developmental Education According to Degree



Students are recommended to enroll in a college survival skills class in the first 15 hours after admission into the college. In this class, all students are required to take LASSI to complete the class and receive credit. These scores are entered into a data set with other basic information about the student. Students who took the LASSI after the developmental sequence were removed from this study.

Sample

The sample contained 1047 students who have enrolled in at least one developmental math class and have taken the LASSI before or during the beginning of the developmental math class sequence. After setting the study's criteria, the original data set was cleaned by eliminating any student with missing data, took the LASSI after completion of the developmental math sequence or entered into an on-level math class. Descriptive statistics were evaluated to make sure the sample was representative of the whole college's demographics.

Research Design

This research study was classified as predictive non-experimental quantitative research using an ex post facto design. An ex post facto design was appropriate since the primary purpose of this study was predictive and the independent variables have already occurred and cannot be manipulated (Johnson, 2001). Ex post facto research was a non-experimental effort to investigate the possible cause-and- effect relationship between the independent variable(s) and the dependent variable(s) (Creswell, 2003; Kumar, 2005). This view confirmed the work of Cohen, Manion, and Morrison (2007) who explained ex post facto research as searching back in time for the possible factors seemingly associated with certain occurrences. Although the results cannot be utilized as proof of a cause and effect relationship, non-experimental research was important to educators to further understand the non-manipulable variables (Mertens, 2005). This post facto design was best to use because of the large number of students studied and the variety of prerequisites for completion of developmental studies.

The study examined the independent variable, the Learning and Study Strategy Inventory (LASSI) and the non-cognitive components examined in the LASSI test, to determine its independent effect on the dependent variable, persistence or completion in developmental mathematics. Completion was defined by the student completing all the requirements needed for a particular program. All programs have developmental math prerequisites but not all students had to take a credit math class.

Instrumentation

The LASSI was a self-report instrument used to assess learning strategies based on learning and cognition (Simon, 1979) and on strategic learning (Weinstein, 1994). Strategic learning was derived from cognitive psychology and evaluates how students processed information and constructed knowledge (Cano, 2006). LASSI scores have been shown to positively correlate with grade point average and predicting academic performance in a university setting (Yip & Chung, 2002).

This instrument was created using a functional approach related to students' learning methods by observation of themes and factors rather than using correlation with an approach with Cronbach's alpha (Swenson, 1977). With the revised LASSI, the authors re-evaluated the three components and ten subscales using a Cronbach's coefficient alpha that ranged from .68 to .86 (Weinstein, Zimmerman, & Palmer, 1988). Even though many pyschometricians disagreed on the validity of a test with coefficient alpha of 0.68, alpha levels should be interpreted with caution, taking the context in consideration (Cortina, 1993; Henson, 2001).

This instrument consists of 80 questions with ten subscales which were grouped by factor analysis in three components: skill, will and self-regulation. The ten subscales were:

1. Attitude – the student's interest to succeed in college; and willingness to perform the tasks necessary for academic success (Alpha .72).

2. Motivation – the degree to which the student accepts the responsibility for performing those tasks by utilizing self-discipline and hard work (Alpha .81).

3. Time Management – the extent to which the student creates and uses schedules to manage effectively his or her responsibilities (Alpha .86).

4. Anxiety – the degree of anxiety the student feels when approaching academic tasks (Alpha .81).

5. Concentration – the ability of the student to focus his or her attention, and avoid distractions, while working on school-related tasks like studying (Alpha .84).

6. Information Processing – the ability to process ideas by mentally elaborating on them and organizing them in meaningful ways (Alpha .83).

7. Selecting Main Ideas – the magnitude of the student's ability to ferret out the important information in a learning situation (Alpha .74).

8. Study Aids – the student's ability to use or develop study aids that help the learning process (Alpha .68).

9. Self-Testing – the student's awareness of the importance of self-testing and reviewing when learning material; and use of those practices (Alpha .75).

10. Test Strategies – the measurement of the student's ability to prepare effectively for an exam and to reason through a question when answering it (Alpha .83).

Data Collection Procedures

Data collection for this data set began in 2002 and was ongoing after the study. Because of the added variables like the LASSI, only 2008 through 2011 were used for this study. All first time degree seeking students were placed in the data set with basic information found on their admission's application. Students applied online and self-reported information such as birth date, address, tax records, social security number, gender, race and previous education. This information was then imported into PeopleSoft8, which is a student and employee information system. After the application was processed, the student was required to take the COMPASS test before enrolling into any classes. The advising center inputted all COMPASS scores into the PeopleSoft8 system.

After completing the COMPASS test, the students were advised on which classes to enroll in. If a student scored below the cutoff for on-level math, the student was referred to a developmental advisor. This developmental advisor went over the strengths and weaknesses of the scores and assisted the student to register for the appropriate developmental class and a student college survival skills class.

Other data that was found in PeopleSoft8 and was added to this research's data set is attendance record for each attempted class, grades, and financial aid eligibility. This data set is secure with a password. The researcher copied the data to a new worksheet. The student identification number and social security numbers were stripped from this data set. A password was added to the new data set in which only the researcher knew.

After the project, all data was discarded. Any paper that contained a student number was shredded.

Data Analysis

This section provided details related to how the ex post facto data was analyzed to answer the research questions regarding (1) the extent to which the LASSI test predict the persistence of developmental math students in community college and (2) which non-cognitive component examined in the LASSI test is most likely to predict a student's completion of a developmental math sequence in community college.

The data for this study was analyzed using the Statistical Program for Social Sciences (SPSS). Descriptive statistics provided information on frequency distribution and means on student demographic, test scores, student enrollment and program of study. Multiple regression statistics were used to analyze relationships between variables and determine the level of predictability between one or multiple variables. Type 1 errors are often a problem in educational research and the alpha level 0.5 is often used in educational research to control for these errors (Ary, Jacobs, & Razavieh, 1996).

After examining the descriptive statistics to compare the means to the population of the whole community college, a Chronbach's alpha reliability test was run to see if the correlation coefficients are the comparable to norms found in the LASSI's manual. If these values were different a possible regrouping or examination of the data was needed.

To answer the first research question about the extent to which the LASSI test predicted the persistence of developmental math completion, a logistical regression was completed using the ten subscales and the completion (coded 1) or failure (coded 0) of developmental math. Logistical regressions were used in the health and social science fields to predict outcomes by using multiple variables to strengthen the prediction of an outcome. The use of logistic regression has increased in the social sciences (Chuang, 1997; Janik& Kravitz, 1994; Tolman & Weisz, 1995) and in educational research, especially in higher education (Austin,Yaffee & Hinkle, 1992; Cabrera, 1994; Peng & So, 2002a; Peng, So, Stage, & St. John, 2002). According to Peng, Lee and Ingersoll (2002) a proper report of a logistical regression did include: an overall evaluation of the logistic model, statistical tests of individual predictors, goodness-of-fit statistics and an assessment of the predicted probabilities.

The second question, which non-cognitive component was the best predictor of completion of developmental math, used a similar method of analysis but the variables were grouped by component designated by the survey's developer. If the study's population did not fit the original grouping after performing the Chronbach's alpha, the components were adjusted and reviewed. The results were displayed in complete regression model equation, table and figure form to show the relationships between the variables and outcomes. The equation did contain the Y intercept as well as the odds ratio, also known as regression coefficients. Tables included descriptive statistical details as well as predicted frequencies.

Summary

This chapter presented the study's research design and approach, including justification for the methodology used to examine the predictability of the LASSI on completion of developmental math. It explained the context of utilizing the data from the LASSI test to form a logistical regression for predictability. The chapter also provided a detailed explanation of the methods, procedures, and data analysis to be conducted for the study in anticipation of explaining the results of analyses in the following chapter. The next chapter will present the results obtained from those methods, procedures, and analysis.

CHAPTER IV: DATA ANALYSIS AND FINDINGS

This chapter presents the data analysis and findings on non-cognitives and developmental mathematics at a community college. The purpose of this study was to explore the ability of non-cognitive traits to predict persistence in completion of a developmental math sequence at a community college. Non-cognitive traits will be identified from the three components of strategic learning found in the Learning and Study Strategy Inventory (LASSI): (a) the skill component (information processing, selecting main ideas and test strategies), (b) the will of the student component (attitude, motivation and anxiety), and (c) the self-regulation component (concentration, time management, self-testing and study aids). A multiple regression analysis was used to find the best possible weighting of the LASSI components to yield a maximum correlation with completion of developmental math.

Two research questions guided this study. The first question was what extent can the LASSI test predict the persistence of developmental math students in community colleges. The second question was which non-cognitive component examined in the LASSI test is most likely to predict a student's completion of a developmental math sequence in community college.

Data was collected from the PeopleSoft8 for this study. This data set contained all students that attended the community college. The data was first filtered to only have students that have taken a math class from 2008 to 2011. Second, the data excluded students that tested into on-level math by using the COMPASS placement test. Depending on the program selected on the initial application to the school, different developmental math prerequisites were required for each student. Student were deleted if

LASSI scores were not available, missing data from application, students enrolled in the wrong class according to their program of study and students enrolled in career certificate programs which vary in developmental math requirements.

Once the process was completed, the data was entered into SPSS to be organized and evaluated. The sample size for this study was 1048 students. To evaluate the data and look for any outliers, descriptive and frequency statistics were extracted for each of the variables. These variables were then used to build a logistic regression model.

Descriptive Statistics

Descriptive statistics were used to understand the subject pool and make sure this sample represented the rest of the community college where this study took place. The following is a summary of the various descriptive statistics extracted by SPSS of the data set. This data was later expanded to show the difference between students who completed the developmental sequence as well as the students who did not.

Table 2

Percentage Frequencies of Demographics and Completions

Demographic	Variable	Frequencies Percentage
Complete Developmental Math	Yes	46.4
	No	53.6
Sex	Male	35.5
	Female	64.5
Age	18-24	49.5
	25-34	24.3
	35-44	10.9
	45-54	11.8
	55<	3.4
Pell Grant	Yes	70.1
	No	29.9
Ethnicity	White	60.5
	Black	36.0
	Hispanic	1.9
	Other	1.6
Credit Math Completed	Yes	15.3
	No	56.8
	Not Needed	27.8

According to Table 2, 64.5 percent of the population was female while 35.5 percent were male. This is typical of a community college where the number of women attending is growing. Almost half of the subjects are traditional students defined by age 24 and under. The next largest age group is 25 to 34 year olds followed by 45 to 54, then 35 to 44 and only 3.4 percent of the subjects are 55 and older. Like the rest of the college, 70.1 percent of the students qualified for a Pell grant which is determined by low income status. As for ethnicity, 60.5 percent of the population was white or Caucasian with the second largest group being African American at 36 percent. Hispanic and other ethnicities which include American Indian, Asian, Pacific Islander, biracial and unspecified are included in 3.5 percent of the population. In this sample, 46.4 percent of the students completed the developmental education sequence in math while 53.6 did not succeed. After completing developmental math only 15.3 completed on-level math requirements. Some degrees, such as Nursing and Health Science did not require an on-level math class at this time.

Table 3

Percent Frequencies of Demographic and Completions based on Completion

		Completion of Developmental Math	
Variable		Yes	No
Sex	Male	35.4	35.6
	Female	64.6	64.4
Age	18-24	45.5	53.0
	25-34	23.5	25.1
	35-44	11.5	10.3
	45-54	14.6	9.4
	55<	4.9	2.2
Pell Grant	Yes	63.2	76.2
	No	36.8	23.8
Ethnicity	White	66.9	55.0
	Black	29.6	41.5
	Hispanic	1.6	2.1
	Other	1.8	1.5
Credit Math Completed	Yes	32.9	0.00
	No	43.8	68.0
	Not Needed	23.3	31.8

The research questions look at students who completed a developmental math sequence needed for a particular program. Some degree programs, such as Welding and Administration of Justice, required one developmental class and one on-level class. The developmental class needed for these degrees and many other applied science degrees is the easiest of four developmental math classes offered at the college. General Studies and Health Science degrees, which account for 45.4 percent of this sample, required all four developmental math classes. The data was split into two groups with students completing the developmental math sequence and students who did not. An independent t-test demonstrated that age (M=-0.28, SD=0.07, t=-3.79) and Pell grant (M=-0.3, SD=0.03, t=4.6) are significantly different between the two groups ($p<.05$).

Table 4

Percent Completed with Placement Score

Percent Complete	Frequency	Percent	Cumulative Percent
.00	103	9.8	9.8
25.00	85	8.1	18.0
33.00	2	.2	18.1
50.00	177	16.9	35.1
66.00	1	.1	35.1
75.00	196	18.7	53.9
100.00	483	46.1	100.0

Table 5

Percent of Classes Needed Completed

Percent Complete	Frequency	Percent	Cumulative Percent
.00	298	28.5	28.5
25.00	37	3.5	32.0
33.00	43	4.1	36.1
50.00	138	13.2	49.3
66.00	36	3.4	52.7
75.00	12	1.1	53.9
100.00	483	46.1	100.0

The COMPASS or ASSET test placed a student in one of the four developmental math classes or into an on-level class. Table 4 shows the percentage completion with placement. In first data row, 9.8 percent of students placed in the lowest level math did not complete this math. Some students could be placed in 50 percent of their program but still not passed a developmental class. Table 5 shows how much developmental math was completed after placement. An example would be a nursing student is required to take four developmental courses and he or she is placed into the third level class. This student has completed 50 percent of his or her program but only passes one class out of the two needed to move to on-level. This student has passed 75 percent of the needed developmental classes with placement (Table 4) but only 50 percent of his or her goal (Table 5).

Table 6

One Way ANOVA Comparing LASSI Percentiles and Completion

	N^2	df	Mean Square	F	Sig.
Anxiety	0.003	1	3061.346	3.575	.059
Attitude	0.000	1	74.752	.083	.774
Concentration	0.003	1	2963.753	3.580	.059
Information Processing	0.000	1	77.429	.100	.752
Motivation	0.004	1	3690.456	4.013	.045
Self-Testing	0.000	1	197.765	.237	.627
Selecting Main Idea	0.003	1	2094.845	2.701	.101
Self-Testing and Study Aids	0.000	1	72.821	.082	.775
Time Management	0.002	1	2031.456	2.391	.122
Test Strategies	0.009	1	8100.119	9.684	.002

When performing a one-way ANOVA on completion of developmental math sequence and LASSI percentile, anxiety, concentration, motivation and test strategies were found statistically significant. After grouping the LASSI subscales into will, skill and self-regulation according to the author of the instrument, an ANOVA was calculated. Will and skill were statistically significant when comparing the means of students who completed the developmental sequence (Table 6).

Table 7

ANOVA of LASSI components and Completion

	N^2	Df	Mean Square	F	Sig
Will	0.004	1	1843.335	3.813	.050
Skill	0.004	1	2454.425	4.569	.033
Self-Regulation	0.002	1	1023.545	1.871	.172

Some of the literature in Chapter 2 disagreed with the grouping originally performed by the instrument creators (Olaussen &Bratten, 1998; Olejnick & Nist, 1992). A Pearson Correlation was done amongst the LASSI percentiles to see what the groupings would be with this population of community college students. Originally, the LASSI subscales were grouped in three components: the skill component (information processing, selecting main ideas and test strategies), the will of the student component (attitude, motivation and anxiety), and the self-regulation component (concentration, time management, self-testing and study aids) (Weinstein, 1994). After examining the correlation, this researched group can be broken into three groups a little different from the original findings. The groups would be test taking (Main Ideas, Test Strategies, Anxiety, Concentration), will (Attitude, Motivation and Time Management) and test preparation (Study Aids, Self-Testing and Information Processing). This grouping looks very similar to Olaussen &Bratten (1998) and Olejnick & Nist (1992). The Pearson Correlation can be seen in Table 8.

Table 8

Correlation of LASSI Subscales

	ANX	ATT	CON	INP	MOT	SFT	SMI	STA	TMT	TST
ANX	1	.166**	.429**	.068*	.145**	.055	.553**	.043	.232**	.568**
ATT	.166**	1	.557**	.362**	.611**	.424**	.415**	.393**	.547**	.455**
CON	.429**	.557**	1	.360**	.536**	.451**	.670**	.354**	.656**	.681**
INP	.068*	.362**	.360**	1	.516**	.618**	.368**	.484**	.401**	.376**
MOT	.145**	.611**	.536**	.516**	1	.532**	.440**	.483**	.589**	.517**
SFT	.055	.424**	.451**	.618**	.532**	1	.362**	.580**	.579**	.346**
SMI	.553**	.415**	.670**	.368**	.440**	.362**	1	.281**	.461**	.780**
STA	.043	.393**	.354**	.484**	.483**	.580**	.281**	1	.508**	.255**
TMT	.232**	.547**	.656**	.401**	.589**	.579**	.461**	.508**	1	.497**
TST	.568**	.455**	.681**	.376**	.517**	.346**	.780**	.255**	.497**	1

Notes: ANX-Anxiety, ATT- Attitude, CON- Concentration, INP- Information Processing, MOT- Motivation, SFT- Self Testing, SMI- Selecting Main Idea, STA- Study Aids, TMT- Time Management, TST- Test Strategies
*denotes significance p<0.05
**denotes significance p<0.01

Table 9

ANOVA of New Components of LASSI

	N^2	df	Mean Square	F	Sig.
Test Preparation	0.00	1	109.467	.186	.666
Non-Cognitives	0.002	1	1456.071	2.266	.133
Testing and Concentration	0.006	1	3768.116	6.461	.011

When executing an ANOVA for the new grouping, only significance was found in Testing and Concentration (Table 9). The other groupings were not significant when comparing the means. To break down the subscales into the different questions, an ANOVA was run on each question to see if the percentiles were different between students who completed developmental math and students who did not.

Lastly to look at the whole test and see if certain items are significant, an ANOVA was performed on each item number. This data table can be found in Appendix D. The item numbers that were significant to a person completing developmental education are below:

Item 5 Test Strategies: In taking test, writing papers, etc., I find I have misunderstood what was wanted and lose points because of it.

Item 38 Test Strategies: When I study for a test, I have trouble figuring out just what to do to learn the material.

Item 52 Test Strategies: I review my answers during essay test to make sure I have made and supported my main points.

Item 54 Study Aids: I use special study helps, such as italics and headings,that are in my textbook.

Item 63 Test Strategies: I do poorly on tests because I find it hard to plan my work within a short period of time.

Item 65 Motivation: I am up-to-date in my class assignments.

Item 67 Time Management: I end up cramming for every test.

Item 78 Anxiety: I get so nervous and confused when taking an examination that I fail to answer questions to the best of my ability.

LASSI Regression

The first question was what extent can the LASSI test predict the persistence of developmental math students in community colleges. A logistical regression was used since the outcomes are binomial with a student either completing the developmental math requirements or not. After running the logistical regression with only subscale factors through SPSS, only test strategies was statistically significant in this model (Table 10). When adding demographic factors into the equation, predictors of success were test strategies again but also age, Pell grant status, and motivation (Table 11).

Table 10

Regression of LASSI Subscales

	B	S.E.	Wald	df	Sig.	Exp(B)
Anxiety	.001	.003	.091	1	.763	1.001
Attitude	-.005	.003	2.595	1	.107	.995
Concentration	.001	.004	.040	1	.841	1.001
Information Processing	-.002	.003	.555	1	.456	.998
Motivation	.005	.003	2.093	1	.148	1.005
Self-Testing	-.001	.003	.036	1	.849	.999
Selecting Main Idea	-.004	.004	1.174	1	.279	.996
Study Aids	-.001	.003	.035	1	.851	.999
Time Management	.001	.003	.159	1	.690	1.001
Test Strategies	.009	.004	5.281	1	.022	1.009
Constant	-.361	.172	4.398	1	.036	.697

Table 11

Logistic Regression with Demographic Variables

	B	S.E.	Wald	df	Sig.	Exp(B)
Sex	.075	.148	.258	1	.612	1.078
Age	.222	.059	14.031	1	.000	1.249
Pell Grant	-.585	.144	16.434	1	.000	.557
Anxiety	.002	.003	.714	1	.398	1.002
Attitude	-.005	.003	2.638	1	.104	.995
Concentration	.000	.004	.014	1	.906	1.000
Information Processing	-.003	.003	.737	1	.391	.997
Motivation	.006	.003	3.830	1	.050	1.006
Self-Testing	.000	.003	.012	1	.914	1.000
Selecting Main Idea	-.004	.004	1.086	1	.297	.996
Study Aids	-.002	.003	.618	1	.432	.998
Time Management	-.001	.003	.022	1	.881	.999
Test Strategies	.010	.004	5.472	1	.019	1.010
Anxiety	-.145	.085	2.924	1	.087	.865
Attitude	-.297	.223	1.770	1	.183	.743

To look at individual questions that could be predictive of a student passing a developmental math sequence, a logistical regression was performed on all the answers to the questions which can be found in Appendix E. Ten of the questions were significant in being a predictor of success in developmental mathematics. Some of the questions were reversed in the survey. The negative B can show this question as being reversed. Some questions that were not reversed but have a negative B are discarded. The following questions were found to be predictive if a student will complete developmental math:

Item 33 Self-Testing: I stop periodically while reading and mentally go over or review what was said.

Item 41 Attitude: I would rather not be in school.

Item 51 Attitude: I dislike most of the work in my classes.

Item 54 Study Aids: I use special study helps, such as italics and headings, that are in my textbook.

Item 65 Motivation: I am up to date on my assignments.

Because of the strong significance seen in the predictability of age and Pell grant recipients, the demographic information was included in the logistical regression. Age and Pell grant were again variables that were predictive as well as the following questions (Appendix F):

Item 51 Attitude: I dislike most of the work in my classes.

Item 54 Study Aids: I use special study helps, such as italics and headings, that are in my textbook.

Item 65 Motivation: I am up to date on my assignments.

Prediction by Components

The second research question was what component can predict the success of a community college student in developmental math. To answer this question, the average percentiles for each group were taken and run against completion of developmental math.

There was not a significant finding when using the original grouping of the components researched by the instrument creators (Table 12). When adding in demographic factors (Table 13), again the grouping of the LASSI subscale into components was not significant. Only age and Pell grant honoree was significantly predictable.

Table 12

Logistical Regression of Components of the LASSI

	B	S.E.	Wald	df	Sig.	Exp(B)
Will	.003	.004	.465	1	.495	1.003
Skill	.005	.004	1.234	1	.267	1.005
Self-Regulation	-.002	.004	.167	1	.683	.998
Constant	-.429	.163	6.903	1	.009	.651

Table 13

Logistical Regression of Components of the LASSI and Demographic Variables

	B	S.E.	Wald	df	Sig.	Exp(B)
Sex	.057	.138	.170	1	.680	1.059
Age	.194	.057	11.337	1	.001	1.213
Pell Grant	-.611	.143	18.330	1	.000	.543
Will	.006	.005	1.598	1	.206	1.006
Skill	.005	.004	1.571	1	.210	1.005
Self-Regulation	-.006	.004	1.879	1	.170	.994
Ethnicity	-.134	.084	2.550	1	.110	.875
Constant	-.300	.206	2.122	1	.145	.741

Shown by the correlation study in Table 8, the student population fit into different components which included test preparation, non-cognitives and testing and concentration. A logistical regression was run through SPSS and the Test and Concentration component was a significant predictor of a student's completion of developmental mathematics (Table 14). When adding in the demographic variables, age, Pell recipient and again, testing and concentration were predictive of a student's success (Table 15).

Table 14

Logistical Regression with New Components

	B	S.E.	Wald	df	Sig.	Exp(B)
Test Preparation	-.003	.003	.551	1	.458	.997
Non-Cognitives	.002	.004	.188	1	.665	1.002
Test and Concentration	.007	.003	4.174	1	.041	1.007
Constant	-.397	.165	5.780	1	.016	.673

Table 15

Logistical Regression with New Components and Demographic Variables

	B	S.E.	Wald	df	Sig.	Exp(B)
Sex	.093	.143	.427	1	.513	1.098
Age	.185	.057	10.656	1	.001	1.203
Pell	-.612	.143	18.396	1	.000	.542
Ethnicity	-.143	.084	2.898	1	.089	.867
Test Preparation	-.004	.003	1.655	1	.198	.996
Non-cognitives	.001	.004	.073	1	.787	1.001
Test and Concentration	.008	.003	5.489	1	.019	1.008
Constant	-.254	.210	1.465	1	.226	.776

Summary

In this chapter the findings for the data analysis were presented. Descriptive statistics were reviewed to look at the demographics and completion rates for developmental mathematics. An independent t-test was used to look at the difference of the means dependent on completion of the developmental math sequence. An one-way ANOVA was used to evaluate the difference of means between the independent variables which included: demographics, subscale percentiles, individual LASSI questions, and the two groupings of the components. To answer the research questions logistical regressions using demographics, subscale percentiles, individual LASSI questions, and the two groupings of the components demonstrated some predictive measures for this model. Chapter V will discuss the results of this study, recommendations for future research and practice and provide some concluding statements.

Chapter V: Discussion, Recommendations and Conclusion

This chapter will discuss the results of this study, recommendations for future research and practice and provide some concluding statements. The purpose of this study was to explore the ability of non-cognitive traits to predict persistence in completion of a developmental math sequence at a community college. Non-cognitive traits were identified from the three components of strategic learning found in the Learning and Study Strategy Inventory (LASSI): (a) the skill component (information processing, selecting main ideas and test strategies), (b) the will of the student component (attitude, motivation and anxiety), and (c) the self-regulation component (concentration, time management, self-testing and study aids). A logistical regression analysis was used to find the best possible weighting of the LASSI components to yield a maximum correlation with completion of developmental math.

Two research questions guided this study. The first question was To what extent can the LASSI test predict the persistence of developmental math students in community colleges? The second question was which non-cognitive component examined in the LASSI test is most likely to predict a student's completion of a developmental math sequence in community college?

The descriptive statistics were consistent with the literature and the population of the community college studied. More women attend community college than men. In 2008, 51 percent of the national student population was older than 24 (NCES, 2009). This number was very similar to what was established in this sample. The gender split in community colleges was 60 percent women and 40 percent men but varied widely by specific programs (Bailey, 2006). Minorities made up 35 percent of the population

(Horn, Nevill, & Griffith, 2006). The sample in the current study was a valid representative of community college students nationwide.

When looking at an independent t-test, age and financial aid qualifications were significantly different between students who completed the developmental math requirements and the students who did not. Students who are younger and students who do not receive the Pell grant are more likely to be retained and complete the developmental math series. This held true through all of the analysis and was also a significant predictor of success with the logistical regression model.

As for use of the LASSI, the subscale that was significant in predicting success in completion was test strategies. When considering in demographic variables, age, financial aid status, and motivation were added to strengthen this model of use with subscales. Even though motivation and test strategies were significant, the predictability was weak.

When looking at individual items of the instrument, three items were predictable of a student completing the requirements. The three items that were significant were:

- *Item 51 Attitude:* I dislike most of the work in my classes.
- *Item 54 Study Aids*: I use special study helps, such as italics and headings, that are in my textbook.
- *Item 65 Motivation:* I am up to date on my assignments.

The second research question was concerned with which component could predict the success of a community college student in developmental math. To answer this question, the average percentiles for each group were taken and examined against completion of developmental math. There was not a significant finding when using the original grouping of the components researched by the instrument creators. When adding in demographic factors again the grouping of the LASSI subscale into components was not significant. Only age and Pell grant designation was significantly predictable.

As indicated by the correlation presented in Chapter IV, the correlation study in Chapter IV, the student population was reorganized into three different components which included Test Preparation, Non-cognitives and Testing and Concentration. A logistical regression was performed through SPSS and the Test and Concentration component was a significant predictor of a student's completion of developmental mathematics. When adding in the demographic variables, age, Pell recipient and testing and concentration were predictive of a student's success.

Recommendations for Practice and Implications

The use of the study will hopefully improve the use of different variables to predict the success of students in developmental mathematics. To assist in retention of this special population, intrusive advising and early intervention strategies are critical for students' persistence. The first recommendation would be to have a new advising protocol that would include questions that were found significant as a predictor of success. The items to include in an advising interview should include:

- *Item 51 Attitude:* I dislike most of the work in my classes.
- *Item 54 Study Aids*: I use special study helps, such as italics and headings, that are in my textbook.
- *Item 65 Motivation:* I am up to date on my assignments.
- *Age:* When were you born?
- *Pell Grant Recipient:* Do you receive financial aid?

The questions above may be used during the first advising session before the student has a chance to take the LASSI in the student development class. One preferred practice to assist a student would be to have every developmental education student take the LASSI the first semester enrolled. The more data gathered on a student early on, the more of a chance this student may be placed in an effective intervention strategy. LASSI scores should be loaded in a common data set that is easily accessible to many personnel on a college campus.

After a student takes the LASSI the first semester of the enrollment, the scores can be uploaded immediately in a data set to be used by advisors and faculty members for intervention recommendations. A low motivation or test strategy score could alert an advisor or faculty member that this student is at risk. Intrusive advising can start after a student has been identified as a risk. Phone calls and emails to a student who has potential to struggle has been seen as a promising practice (Kuh, 2008; Serrata, McKay, & Hernandez, 2007; Tinto, 2007).

Another recommendation for practice could be that instructors receive a report on each student in their class with LASSI component and individual subscale scores to know which students are at higher risk. This would give an instructor a better idea of who might need the extra care in the class to be successful. Students may also be grouped in class by these scores. A student who is very motivated might encourage another student who is not through peer pressure and social interaction.

Nationally, many researchers have shown that a student who moves through developmental mathematics faster is more likely to persist. With these accelerated models, some students are successful and others are not. A student who is more likely to persist will be a better candidate at the accelerated model. A risk score might help advisors and faculty members to recommend an accelerated path or a traditional path. By using the regression analysis, a weighting of demographics and LASSI items, scores and components may be used to look at a student's potential in an accelerated program.

Students who fail a class and repeat the same class are less likely to complete the developmental math sequence. Students who fail a class should have an increase in intrusive advising as well as a list of strategies to pass the class. Recommendations for using the math lab or tutoring center should be encouraged as well as having an advisor keep track of academic progress. If a student is really struggling, a disabilities evaluation might also be helpful to assist the student.

Finally many national recommendations have been set forward that a developmental student should take a student development class with his or her developmental classes. The students in this study were enrolled in a student development class early on because of college policy. The LASSI testing was one component of this class. Instructors in the class help students evaluate their own scores and give helpful test preparation, note taking, and test strategies.

Recommendations for Further Research

This research study has opened the door for additional research on persistence and completion of developmental mathematics. Only a few variables were used in this model to look at predictability. Every student has many attributes that can predict success or failure. The first step to expand this model would be to introduce other variables into the equation. Such student variables would include attendance, number of visits to the tutoring center, high school GPA, years since last math class, placement test scores, parent education, the number of classes in which the student is enrolled, and outside work obligations.

Use of other instruments to look at non-cognitives and learning strategies would strengthen the use of these affective domains to predict success of a student. The use of another instrument with this population could strengthen this model for intervention strategies. Adding other non-cognitves and learning strategies to the ten subscales in the LASSI could assist in evaluating the developmental mathematics population.

Early intervention strategies are needed to keep a student retained to finish or transfer. A student who completes the developmental sequence is more likely to be retained in credit classes and on to graduation. The same variables should be used to examine the population that completes a post-secondary degree or transfers. This would help in evaluating non-cognitives and learning strategies for all community college students not just developmental. Completing developmental education is only the first step to the goals of many students who wish to graduate or transfer.

This study was based on an ex post facto dataset that was collected for a grant. To understand the whole dynamics of students who persist and those who do not, a mixed methods approach might be helpful in the future. A qualitative approach can begin with an interview of each student the first semester of enrollment. A follow-up interview would be important if a student fails a developmental class or does not come back for a second class. Surveys that include open ended questions as well as Likert-type quantitative items could be used because of the size of this population. Codeable themes could be collected to give better insight on why a student does or does not persist through developmental mathematics.

This sample was taken at one rural community college. This model should be tested on larger and more urban institutions. The larger population pool would validate this research. Since this data was specific to the population studied, this model could be adapted to any institution. The individual institution can use the research protocols and research what items, subscales and components best fit the student population for advising.

Other developmental classes are offered at community colleges. Most colleges offer reading and writing as developmental classes. The sequence for these classes can be from two to four courses depending on placement scores. Further research may be performed using this procedure for developmental English classes. Students that take multiple developmental classes should be examined and look at risk of attrition. A new research question could be what variables can be used to predict success of a developmental student in both English and in math.

Conclusion

Math may be the single most important predictor related to success in college and beyond (Drew, 1996). Many entry level careers require a basic understanding of math, and math is imperative for existing and emerging jobs in a global, information and technology-based economy (Bureau of Labor Statistics, 2008; Drew, 1996). Millions of jobs, including most of the lucrative jobs, require some type of mathematical skill (Buchner, Smits & Van der Velden, 2012).

The purpose of this study was to find non-cognitive variables that would help predict success or failure in a developmental mathematics student. The LASSI score were analyzed by looking at individual items, the ten subscales and two variations of grouping of components. A logistical regression showed the strength of correlation to predict the success of students at a community college. With an open door policy, colleges need to identify students that are in danger of attrition and provide additional support that will increase the likelihood of their success. Using multiple measures of nonacademic variables need to be included in a full student assessment. Along with prior academic background and demographics, non-cognitive variables and learning strategies can only strengthen the predictability of student attrition. With this knowledge early on in a student's enrollment, proper intervention strategies can be used to assist in the student's success. This conclusion challenges community college leaders to target all problem areas in their approach to identify high risk students.

Collecting the different non-cognitive variables from the LASSI will assist developmental educators, advisors, and administrators. By using the regression model formulated from this study, a risk score based on non-cognitives and basic demographics can help with placement of a developmental student. Many schools have accelerated models or learning communities for developmental math. The risk score would help an advisor recommend the proper instructor or class structure for at-risk individuals.

Multiple retention strategies are needed to assist the success of developmental students and credit math students Developmental students are more successful when a variety of retention strategies are used at a community college (Pascarella &Terenzini, 2005). Such strategies include advising, counseling, interactive teaching strategies, and comprehensive support services. One particular intervention has not had the same statistical result as the combination of strategies. When working with developmental students, retention strategies are needed to increase graduation and transfer rates at community colleges. Because of the large barrier of developmental math, new strategies need to be implemented for success.

On a global level, a more competitive workforce is needed to keep jobs in the United States. Academic and technical skills are a must when advancing industries. Quantitative skills will even become more important in every industry with the advancements of technology and computer science. Mathematical reasoning skills are seen everywhere from finances, medical records, politics, current events and social policy.

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Appendix A: LASSI Subscales

Attitude (ATT)

The **Attitude Scale** assesses students' attitudes and interest in college and academic success. It examines how facilitative or debilitative their approach to college and academics is for helping them get their work done and succeeding in college (sample item: I feel confused and undecided as to what my educational goals should be). Students who score low on this scale may not believe college is relevant or important to them and may need to develop a better understanding of how college and their academic performance relates to their future life goals.

Motivation (MOT)

The **Motivation Scale** assesses students' diligence, self-discipline, and willingness to exert the effort necessary to successfully complete academic requirements (sample item: When work is difficult I either give up or study only the easy parts). Students who score low on this scale need to accept more responsibility for their academic outcomes and learn how to set and use goals to help accomplish specific tasks.

Time Management (TMT)

The **Time Management Scale** assesses students' application of time management principles to academic situations (sample item: I only study when there is the pressure of a test). Students who score low on this scale may need to develop effective scheduling and monitoring techniques in order to assure timely completion of academic tasks and to avoid procrastination while realistically including non-academic activities in their schedule.

Anxiety (ANX)

The **Anxiety Scale** assesses the degree to which students worry about school and their academic performance. Students who score low on this scale are experiencing high levels of anxiety associated with school (note that this scale is reverse scored). High levels of anxiety can help direct attention away from completing academic tasks (sample item: Worrying about doing poorly interferes with my concentration on tests). Students who score low on this scale may need to develop techniques for coping with anxiety and reducing worry so that attention can be focused on the task at hand.

Concentration (CON)

The **Concentration Scale** assesses students' ability to direct and maintain attention on academic tasks (sample item: I find that during lectures I think of other things and don't really listen to what is being said). Low scoring students may need to learn to monitor their level of concentration and develop techniques to redirect attention and eliminate interfering thoughts or feelings so that they can be more effective and efficient learners.

Information Processing (INP)

The **Information Processing Scale** assesses how well students' can use imagery, verbal elaboration, organization strategies, and reasoning skills as learning strategies to help build bridges between what they already know and what they are trying to learn and remember, i.e., knowledge acquisition, retention and future application (sample item: I translate what I am studying into my own words). Students who score low on this scale may have difficulty making information meaningful and storing it in memory in a way that will help them recall it in the future.

Selecting Main Ideas (SMI)

The **Selecting Main Ideas Scale** assesses students' skill at identifying important information for further study from among less important information and supporting details (sample item: Often when studying I seem to get lost in details and can't see the forest for the trees). Students who score low on this scale may need to develop their skill at separating out critical information on which to focus their attention. Tasks such as reading a textbook can be overwhelming if students focus on every detail presented.

Study Aids (STA)

The **Study Aids Scale** assesses students' use of supports or resources to help them learn or retain information (sample item: I use special helps, such as italics and headings, that are in my textbooks). Students with low scores may need to develop a better understanding of the resources available to them and how to use of these resources to help them be more effective and efficient learners.

Self-Testing (SFT)

The **Self-Testing Scale** assesses students' use of reviewing and comprehension monitoring techniques to determine their level of understanding of the information to be learned (sample item: I stop periodically while reading and mentally go over or review what was said). Low scoring students may need to develop an appreciation for the importance of self-testing, and learn effective techniques for reviewing information and monitoring their level of understanding or ability to apply what they are learning.

Test Strategies (TST)

The **Test Strategies Scale** assesses students' use of test preparation and test taking strategies (sample item: In taking tests, writing themes, etc., I find I have misunderstood what is wanted and lose points because of it). Low scoring students may need to learn more effective techniques for preparing for and taking tests so that they are able to effectively demonstrate their knowledge of the subject matter.

Responses available to the survey participants:
1. Not at all typical of me
2. Not very typical of me
3. Somewhat typical of me
4. Fairly typical of me
5. Very much typical of me

Example questions:
1. I concentrate fully when studying.
2. I am unable to summarize what I have just heard in a lecture or read in a textbook.
3. I try to find relationships between what I am learning and what I already know.
4. I find it hard to stick to a study schedule.
5. In taking tests, writing papers, etc., I find I have misunderstood what was wanted and lose points because of it.
6. I am able to study subjects I do not find interesting.
7. When I decide to study, I set aside a specific length of time and stick to it.
8. Because I don't listen carefully, I don't understand some course material.
9. I try to identify potential test questions when reviewing my class material.
10. During class discussions, I have trouble figuring out what is important enough to put in my notes.
11. To help me remember new principles we are learning in class, I practice applying them.
12. My underlining is helpful when I review text material.
13. When it comes to studying, procrastination is a problem for me.
14. I set high standards for myself in school.
15. When I am studying a topic, I try to make everything fit together logically.

Taken from: http://www.hhpublishing.com/_assessments/LASSI/samples.html

Appendix B: Sample Log In

LASSI Learning And Study Strategies Inventory

by
Claire E. Weinstein, Ph.D.,
Department of Educational Psychology, University of Texas at Austin
David R. Palmer, Ph.D.
Texas Health and Human Services Commission
Ann C. Schulte, Ph.D.
University of North Carolina

This page is for preview purposes only. Follow the links below to review the directions to the student, the LASSI assessment, and a sample student profile. When you are finished reviewing the student section, take a moment to look over the sample reports available to instructors.

Directions

The Learning and Study Strategies Inventory (LASSI) is designed to gather information about learning and study practices and attitudes. Upon submission and approval of your school number, several statements will be presented that relate to learning and studying.

You are to read each statement and then select a response according to the following key:

[* Make a Selection * ▼] <--- Click on the pull-down menu to the left to select your response.

To help you decide which responses to select, we would like to explain what is meant by each term.

- By **Not at all typical of me,** we do not necessarily mean that the statement would never describe you, but that it would be true of you only in rare instances.
- By **Not very typical of me,** we mean that the statement generally would not be true of you.
- By **Somewhat typical of me,** we mean that the statement would be true of you about half the time.
- By **Fairly typical of me,** we mean that the statement would generally be true of you.
- By **Very much typical of me,** we do not necessarily mean that the statement would always describe you, but that it would be true of you almost all the time.

Before you begin it is important to know whether you have taken the LASSI previously. Choose the correct box below.

First Administration	Second Administration
If this is your first time taking the LASSI, enter your school number, user name, and password into the space below and click the "Submit" button to continue.	If you are taking this assessment for the second time (Post-Test), enter your school number and your student key into the spaces below and click the "Take Post-Test" button.
99999	

Enter Your **User Name:** demo

Enter Your **Password:** ****

Submit

[redacted]

* Enter Your **Student Key:**

*Note: Your student key was issued the first time you took the LASSI. If you misplaced your student key, your advisor/instructor can look it up for you.

Appendix C: Sample LASSI Test

LASSI Learning And Study Strategies Inventory

Enter your first name, last name, ID number, and e-mail address into the spaces below, and then click the Continue button.

School Number: 99999

First Name: Joe

Last Name: Student

ID Number: 12-34567 (optional)

E-mail Address: j_student@univ.edu (optional)

☑ Check the box to have your LASSI results emailed to you. You will be able to view and print your results regardless of whether you check the box.

This page is for preview purposes only. An email will not be sent. Click the "Continue" button to continue the demo.

Continue

Joe Student School Number: 999999

ID Number: 12-34567 j_student@univ.edu

This page is for preview purposes only. You are shown 15 of the 80 statements of the LASSI assessment. Your results will not be scored or recorded. Click the "Submit Your Answers " button at the bottom of the page to view a sample student profile.

Try to answer according to how well the statement describes you, not how you think you should be or what others do. There are no right or wrong answers to these statements. Please work as quickly as you can without being careless and please answer all the items.

---

1. I concentrate fully when studying.

* Make a Selection *

---

2. I am unable to summarize what I have just heard in a lecture or read in a textbook.

* Make a Selection *

---

3. I try to find relationships between what I am learning and what I already know.

* Make a Selection *

---

4. I find it hard to stick to a study schedule.

* Make a Selection *

---

5. In taking tests, writing papers, etc., I find I have misunderstood what was wanted and lose points because of it.

* Make a Selection *

---

6. I am able to study subjects I do not find interesting.

* Make a Selection *

---

7. When I decide to study, I set aside a specific length of time and stick to it.

* Make a Selection *

---

8. Because I don't listen carefully, I don't understand some course material.

* Make a Selection *

---

9. I try to identify potential test questions when reviewing my class material.

* Make a Selection *

---

10. During class discussions, I have trouble figuring out what is important enough to put in my notes.

* Make a Selection *

---

11. To help me remember new principles we are learning in class, I practice applying them.

* Make a Selection *

---

12. My underlining is helpful when I review text material.

* Make a Selection *

---

13. When it comes to studying, procrastination is a problem for me.

* Make a Selection *

---

14. I set high standards for myself in school.

* Make a Selection *

---

15. When I am studying a topic, I try to make everything fit together logically.

* Make a Selection *

After responding to the above statements, click the "Submit Your Answers" button to view and print your results.

Submit Your Answers

Appendix D: Sample Score Report

Learning and Study Strategies Inventory (LASSI) Student Report

Joe Student	School #: 99999
3/2/2010	Student Key: St77668J
ID Number: 12-34567	j_student@univ.edu

The graph below interprets your responses to the LASSI. The numbers on the top and bottom of the chart show percentile ranks. You can use these percentile ranks to compare your scores to other individuals' scores. For example, if you scored in the 80th percentile in Attitude and Interest (ATT), you scored higher than 80 percent of other individuals answering the same questions.

As you work to improve your scores, your advisor/instructor may want you to take this assessment again. If you do take it a second time, you will need your student key. Your student key is St77668J.

LASSI Scores

```
     01   05   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
85   90   95   99

ANX  ---------------------------------------|------------------->

ATT  ------------>                          |                   |

CON  -------------------------------->      |                   |

INP  >                                      |                   |

MOT  >                                      |                   |

SFT  ---->                                  |                   |

SMI  ---------------------------------------|----------->       |

STA  >                                      |                   |

TMT  ------------------------------------>  |                   |

TST  ---------------------------------------|--------------->   |

     01   05   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
85   90   95   99
```

75 - 100	If you scored **above the 75th percentile** on any of the ten LASSI scales, you probably do not have to give a high priority to improving your strategies in those areas.
50 - 75	If you scored **between the 75th and the 50th percentiles** on any of the ten scales, you should consider improving your strategies for those scales.
0 - 50	If you scored **below the 50th percentile** on any of the ten scales.

	you need to improve your skills to avoid serious problems succeeding in college.

Interpreting Your LASSI Scores	
Anxiety (ANX) **Percentile Score:** 75	The **Anxiety Scale** assesses the degree to which students worry about school and their academic performance. Students who score low on this scale are experiencing high levels of anxiety associated with school (note that this scale is reverse scored). High levels of anxiety can help direct attention away from completing academic tasks (sample item: When I am studying, worrying about doing poorly in a course interferes with my concentration). Students who score low on this scale may need to develop techniques for coping with anxiety and reducing worry so that attention can be focused on the task at hand.
Attitude (ATT) **Percentile Score:** 15	The **Attitude Scale** assesses students' attitudes and interest in college and academic success. It examines how facilitative or debilitative their approach to college and academics is for helping them get their work done and succeeding in college (sample item: I have a positive attitude about attending my classes). Students who score low on this scale may not believe college is relevant or important to them and may need to develop a better understanding of how college and their academic performance relates to their future life goals.
Concentration (CON) **Percentile Score:** 40	The **Concentration Scale** assesses students' ability to direct and maintain attention on academic tasks (sample item: I find that during lectures I think of other things and don't really listen to what is being said). Low scoring students may need to learn to monitor their level of concentration and develop techniques to redirect attention and eliminate interfering thoughts or feelings so that they can be more effective and efficient learners.
Information Processing (INP) **Percentile Score:** 1	The **Information Processing Scale** assesses how well students' can use imagery, verbal elaboration, organization strategies, and reasoning skills as learning strategies to help build bridges between what they already know and what they are trying to learn and remember, i.e., knowledge acquisition, retention and future application (sample item: I translate what I am studying into my own words). Students who score low on this scale may have difficulty making information meaningful and storing it in memory in a way that will help them recall it in the future.
Motivation (MOT) **Percentile Score:** 1	The **Motivation Scale** assesses students' diligence, self-discipline, and willingness to exert the effort necessary to successfully complete academic requirements (sample item: When work is difficult I either give up or study only the easy parts). Students who score low on this scale need to accept more responsibility for their academic outcomes and learn how to set and use goals to help accomplish specific tasks.
Self-Testing (SFT) **Percentile Score:** 5	The **Self-Testing Scale** assesses students' use of reviewing and comprehension monitoring techniques to determine their level of understanding of the information to be learned (sample item: I stop periodically while reading and mentally go over or review what was said). Low scoring students may need to develop an appreciation for the importance of self-testing, and learn effective techniques for reviewing information and monitoring their level of understanding or ability to apply what they are learning.
Selecting Main Ideas (SMI) **Percentile Score:** 65	The **Selecting Main Ideas Scale** assesses students' skill at identifying important information for further study from among less important information and supporting details (sample item: When studying, I seem to get lost in the details and miss the important information). Students who score low on this scale may need to develop their skill at separating out critical information on which to focus their attention. Tasks such as reading a textbook can be overwhelming if students focus on every detail presented.
Study Aids (STA) **Percentile Score:** 1	The **Study Aids Scale** assesses students' use of supports or resources to help them learn or retain information (sample item: I use special study helps, such as italics and headings, that are in my textbooks). Students with low scores may need to develop a better understanding of the resources available to them and how to use these resources to help them be more effective and efficient learners.
Time Management (TMT) **Percentile Score:** 45	The **Time Management Scale** assesses students' application of time management principles to academic situations (sample item: I set aside more time to study the subjects that are difficult for me). Students who score low on this scale may need

	to develop effective scheduling and monitoring techniques in order to assure timely completion of academic tasks and to avoid procrastination while realistically including non-academic activities in their schedule.
Test Strategies (TST) **Percentile Score:** 70	The **Test Strategies Scale** assesses students' use of test preparation and test taking strategies (sample item: In taking tests, writing papers, etc., I find I have misunderstood what is wanted and lose points because of it). Low scoring students may need to learn more effective techniques for preparing for and taking tests so that they are able to effectively demonstrate their knowledge of the subject matter.

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Appendix E: ANOVA Of Instrument Questions

ANOVA of Instrument Questions

	Sum of Squares	df	Mean Square	F	Sig.
Item1	1.592	1	1.592	1.932	.165
Item2	.353	1	.353	.271	.603
Item3	1.322	1	1.322	1.190	.276
Item4	.182	1	.182	.117	.733
Item5	10.083	1	10.083	7.981	.005
Item6	1.337	1	1.337	.962	.327
Item7	.041	1	.041	.025	.874
Item8	3.409	1	3.409	3.136	.077
Item9	.012	1	.012	.009	.926
Item10	1.049	1	1.049	.699	.403
Item11	3.783	1	3.783	3.362	.067
Item12	2.008	1	2.008	1.496	.222
Item13	.282	1	.282	.172	.678
Item14	.696	1	.696	.689	.407
Item15	.612	1	.612	.651	.420
Item16	1.736	1	1.736	1.469	.226
Item17	.001	1	.001	.000	.982
Item18	.833	1	.833	.534	.465
Item19	1.108	1	1.108	1.263	.261

Continue Appendix E

Item20	.211	1	.211	.130	.719
Item21	.945	1	.945	.768	.381
Item22	2.032	1	2.032	1.767	.184
Item23	.164	1	.164	.161	.688
Item24	3.265	1	3.265	2.907	.088
Item25	.473	1	.473	.355	.551
Item26	2.483	1	2.483	2.358	.125
Item27	.984	1	.984	.872	.351
Item28	2.776	1	2.776	1.801	.180
Item29	3.238	1	3.238	1.823	.177
Item30	3.255	1	3.255	3.190	.074
Item31	.413	1	.413	.312	.577
Item32	3.807	1	3.807	2.476	.116
Item33	3.790	1	3.790	3.132	.077
Item34	.002	1	.002	.001	.971
Item35	.165	1	.165	.097	.755
Item36	.245	1	.245	.288	.592
Item37	.709	1	.709	.538	.464
Item38	14.699	1	14.699	12.461	.000
Item39	.931	1	.931	.984	.321
Item40	.024	1	.024	.015	.902
Item41	1.388	1	1.388	1.284	.257

Continue Appendix E

Item42	.132	1	.132	.126	.722
Item43	3.337	1	3.337	2.019	.156
Item44	.017	1	.017	.013	.910
Item46	5.139	1	5.139	2.684	.102
Item47	.376	1	.376	.298	.585
Item48	.853	1	.853	1.078	.299
Item49	.812	1	.812	.634	.426
Item50	.751	1	.751	.627	.429
Item51	.204	1	.204	.234	.629
Item52	4.320	1	4.320	4.024	.045
Item53	.798	1	.798	.704	.401
Item54	8.647	1	8.647	6.185	.013
Item55	5.026	1	5.026	3.366	.067
Item56	.003	1	.003	.003	.953
Item57	3.711	1	3.711	3.135	.077
Item58	1.036	1	1.036	.900	.343
Item59	.636	1	.636	.681	.409
Item60	.109	1	.109	.082	.774
Item61	2.247	1	2.247	1.455	.228
Item62	1.335	1	1.335	1.022	.312
Item63	6.447	1	6.447	5.789	.016
Item64	2.071	1	2.071	2.191	.139

Continue Appendix E

Item65	7.897	1	7.897	9.438	.002
Item66	1.762	1	1.762	1.283	.258
Item67	5.099	1	5.099	3.869	.049
Item68	.022	1	.022	.022	.883
Item69	3.193	1	3.193	2.269	.132
Item70	.120	1	.120	.366	.545
Item71	3.085	1	3.085	2.085	.149
Item72	.044	1	.044	.027	.870
Item73	2.199	1	2.199	2.134	.144
Item74	.946	1	.946	.774	.379
Item75	2.344	1	2.344	2.174	.141
Item76	1.758	1	1.758	2.675	.102
Item77	.042	1	.042	.031	.861
Item78	9.480	1	9.480	6.158	.013
Item79	.198	1	.198	.157	.692
Item80	2.081	1	2.081	2.105	.147

Appendix F: Regression Analysis Of LASSI Questions

	B	S.E.	Wald	df	Sig.	Exp(B)
Item1	.040	.093	.180	1	.672	1.040
Item2	.027	.065	.171	1	.679	1.027
Item3	.109	.079	1.879	1	.170	1.115
Item4	-.038	.069	.306	1	.580	.962
Item5	.073	.075	.947	1	.331	1.076
Item6	.040	.061	.443	1	.506	1.041
Item7	-.033	.068	.238	1	.626	.967
Item8	.089	.082	1.193	1	.275	1.093
Item9	-.043	.071	.373	1	.541	.958
Item10	-.021	.069	.096	1	.756	.979
Item11	-.234	.080	8.599	1	.003	.792
Item12	-.106	.070	2.327	1	.127	.899
Item13	-.097	.073	1.772	1	.183	.908
Item14	-.005	.086	.004	1	.951	.995
Item15	.062	.086	.516	1	.472	1.064
Item16	-.034	.086	.154	1	.695	.967
Item17	-.085	.074	1.314	1	.252	.919
Item18	.111	.070	2.530	1	.112	1.118
Item19	-.034	.083	.171	1	.679	.966
Item20	-.015	.059	.067	1	.796	.985
Item21	-.089	.085	1.099	1	.294	.915

Continue Appendix F

Item22	.004	.084	.002	1	.960	1.004
Item23	-.016	.087	.035	1	.851	.984
Item24	.054	.091	.344	1	.558	1.055
Item25	.021	.087	.056	1	.813	1.021
Item26	.037	.085	.192	1	.661	1.038
Item27	-.147	.075	3.885	1	.049	.863
Item28	.049	.081	.377	1	.539	1.051
Item29	-.007	.063	.014	1	.906	.993
Item30	.122	.088	1.924	1	.165	1.129
Item31	-.018	.085	.043	1	.835	.982
Item32	.039	.084	.218	1	.640	1.040
Item33	.134	.074	3.329	1	.068	1.144
Item34	.007	.061	.015	1	.904	1.007
Item35	-.083	.073	1.306	1	.253	.920
Item36	.043	.091	.225	1	.635	1.044
Item37	.078	.079	.980	1	.322	1.081
Item38	.247	.089	7.757	1	.005	1.281
Item39	-.021	.092	.054	1	.816	.979
Item40	.026	.065	.161	1	.688	1.027
Item41	-.185	.081	5.216	1	.022	.831
Item42	-.104	.087	1.422	1	.233	.901
Item43	-.003	.080	.001	1	.973	.997

Continue Appendix F

Item44	-.071	.076	.874	1	.350	.932
Item45	-.096	.090	1.153	1	.283	.908
Item46	.009	.062	.023	1	.880	1.009
Item47	-.092	.097	.918	1	.338	.912
Item48	.098	.089	1.215	1	.270	1.103
Item49	.082	.088	.868	1	.351	1.086
Item50	.080	.088	.825	1	.364	1.083
Item51	-.186	.095	3.857	1	.050	.830
Item52	.052	.084	.387	1	.534	1.053
Item53	-.127	.094	1.835	1	.176	.880
Item54	.153	.068	5.017	1	.025	1.165
Item55	.121	.089	1.874	1	.171	1.129
Item56	-.165	.105	2.475	1	.116	.848
Item57	.045	.087	.264	1	.607	1.046
Item58	.100	.080	1.589	1	.207	1.106
Item59	.027	.090	.088	1	.767	1.027
Item60	-.092	.081	1.299	1	.254	.912
Item61	.063	.075	.697	1	.404	1.065
Item62	.048	.081	.357	1	.550	1.049
Item63	.085	.086	.995	1	.318	1.089
Item64	.094	.090	1.085	1	.298	1.099
Item65	.307	.094	10.734	1	.001	1.360

Continue Appendix F

Item66	.016	.069	.054	1	.817	1.016
Item67	.126	.078	2.573	1	.109	1.134
Item68	-.220	.097	5.195	1	.023	.802
Item69	-.014	.089	.023	1	.879	.986
Item70	-.054	.139	.153	1	.696	.947
Item71	-.057	.066	.740	1	.390	.945
Item72	-.071	.068	1.087	1	.297	.932
Item73	-.050	.094	.278	1	.598	.952
Item74	-.193	.090	4.594	1	.032	.824
Item75	.019	.078	.059	1	.808	1.019
Item76	.113	.105	1.168	1	.280	1.120
Item77	.046	.075	.384	1	.536	1.048
Item78	.097	.077	1.568	1	.210	1.102
Item79	-.117	.086	1.844	1	.174	.890
Item80	.055	.092	.360	1	.549	1.057
Constant	-1.147	.775	2.193	1	.139	.317

Appendix G: Regression Analysis Of LASSI Questions With Demographics

	B	S.E.	Wald	df	Sig.	Exp(B)
Sex	-.055	.166	.110	1	.740	.946
Age	.256	.070	13.400	1	.000	1.291
Pell	-.574	.159	13.029	1	.000	.564
Ethnicity	-.107	.091	1.405	1	.236	.898
Item1	.076	.095	.630	1	.427	1.079
Item2	.034	.066	.261	1	.610	1.034
Item3	.082	.081	1.020	1	.313	1.085
Item4	-.057	.071	.646	1	.422	.944
Item5	.074	.076	.931	1	.335	1.077
Item6	.026	.062	.182	1	.670	1.027
Item7	-.039	.069	.322	1	.570	.961
Item8	.115	.084	1.872	1	.171	1.122
Item9	-.044	.072	.378	1	.539	.957
Item10	-.028	.070	.157	1	.692	.972
Item11	-.218	.081	7.278	1	.007	.804
Item12	-.119	.071	2.806	1	.094	.888
Item13	-.111	.074	2.244	1	.134	.895
Item14	.024	.088	.073	1	.787	1.024
Item15	.056	.089	.398	1	.528	1.058
Item16	-.011	.088	.016	1	.900	.989
Item17	-.081	.076	1.127	1	.288	.922

Continue Appendix G

Item18	.105	.071	2.159	1	.142	1.111
Item19	-.022	.085	.065	1	.799	.979
Item20	-.022	.060	.131	1	.718	.979
Item21	-.075	.087	.749	1	.387	.928
Item22	-.026	.085	.091	1	.763	.975
Item23	.010	.089	.013	1	.910	1.010
Item24	.081	.093	.746	1	.388	1.084
Item25	-.008	.090	.008	1	.927	.992
Item26	.049	.087	.313	1	.576	1.050
Item27	-.121	.076	2.530	1	.112	.886
Item28	.080	.083	.927	1	.336	1.083
Item29	-.002	.064	.001	1	.975	.998
Item30	.162	.089	3.283	1	.070	1.175
Item31	-.029	.087	.114	1	.735	.971
Item32	-.005	.087	.003	1	.958	.995
Item33	.117	.075	2.459	1	.117	1.124
Item34	-.034	.063	.281	1	.596	.967
Item35	-.088	.075	1.392	1	.238	.915
Item36	.020	.092	.047	1	.828	1.020
Item37	.075	.081	.862	1	.353	1.078
Item38	.251	.090	7.737	1	.005	1.285
Item39	.004	.094	.002	1	.965	1.004

Continue Appendix G

Item40	.022	.066	.108	1	.743	1.022
Item41	-.125	.083	2.280	1	.131	.882
Item42	-.078	.089	.780	1	.377	.925
Item43	.005	.082	.004	1	.950	1.005
Item44	-.100	.077	1.662	1	.197	.905
Item45	-.122	.093	1.747	1	.186	.885
Item46	.032	.064	.254	1	.614	1.033
Item47	-.066	.099	.451	1	.502	.936
Item48	.099	.091	1.183	1	.277	1.104
Item49	.062	.090	.481	1	.488	1.064
Item50	.056	.089	.388	1	.533	1.057
Item51	-.201	.097	4.290	1	.038	.818
Item52	.079	.085	.855	1	.355	1.082
Item53	-.131	.096	1.879	1	.170	.877
Item54	.162	.070	5.324	1	.021	1.175
Item55	.119	.091	1.738	1	.187	1.127
Item56	-.145	.108	1.821	1	.177	.865
Item57	.046	.089	.266	1	.606	1.047
Item58	.089	.082	1.181	1	.277	1.093
Item59	.025	.093	.073	1	.786	1.025
Item60	-.052	.083	.392	1	.531	.950
Item61	.054	.077	.495	1	.482	1.056

Continue Appendix G

Item62	-.018	.083	.046	1	.829	.982
Item63	.075	.087	.731	1	.392	1.078
Item64	.097	.092	1.113	1	.292	1.101
Item65	.302	.096	9.857	1	.002	1.352
Item66	-.006	.071	.006	1	.936	.994
Item67	.137	.079	2.973	1	.085	1.147
Item68	-.205	.099	4.303	1	.038	.814
Item69	-.033	.091	.133	1	.715	.967
Item70	-.062	.142	.190	1	.663	.940
Item71	-.058	.067	.740	1	.390	.944
Item72	-.043	.070	.377	1	.539	.958
Item73	-.078	.096	.663	1	.415	.925
Item74	-.183	.092	3.972	1	.046	.832
Item75	.014	.080	.030	1	.862	1.014
Item76	.077	.106	.529	1	.467	1.080
Item77	.059	.077	.583	1	.445	1.060
Item78	.112	.079	2.006	1	.157	1.118
Item79	-.150	.088	2.921	1	.087	.861
Item80	.018	.094	.034	1	.853	1.018
Constant	-1.091	.791	1.903	1	.168	.336

Vita

Megan Healy holds a BS in Animal Science from Virginia Tech, a MS in Health and Movement Science from Virginia Commonwealth University and a PhD in Community College Leadership from Old Dominion University. Megan has worked with different organizations to better improve the quality of life for individuals. She was a health consultant for Virginia Tech Extension and then moved to work for Patrick Henry Community College as a biology and developmental math instructor. At the community college, she has taken on many roles as Southern Center for Active Learning Excellence Co-Director, Interim Virginia Community College System (VCCS) Coordinator of Developmental Education and VCCS Legislative intern and consultant. Research has been a passion with an undergraduate research scholarship at Virginia Tech, a summer fellow at NIH and Pediatrics Association researcher for adolescent obesity.