

GPA, retention and persistence for developmental education students enrolled in learning strategies courses as mitigated by motivation and modality

by

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B.A., William Jewell College, 2012

M.S., William Jewell College, 2016

AN ABSTRACT OF A DISSERTATION

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Abstract

Developmental education is a subject of increasing interest, and many current educational reforms are aimed at helping developmental students to succeed. As such, outcomes for developmental students are important for evaluating programs and supports offered to students in this situation. One such support is learning strategies coursework. Prior research has supported the efficacy of these courses (Boylan et al., 1997; Goldrick-Rab, 2010; Kolenovic et al., 2013; Rutschow & Schneider, 2011), so at the institution of study, one such course was offered to developmental students for free as a means to help developmental students navigate the transition to credit-bearing courses. For this study, GPA, retention, and persistence were obtained in order to evaluate the impact of this course on students. For students who took the scholarship as opposed to students who did not, retention (reenrollment the subsequent semester) and persistence (reenrollment, transfer, or graduation) were higher for students who took the course as opposed to those who did not when matching on demographic characteristics and prior GPA. As motivational traits are correlated with GPA (Almalki, 2019; Fong et al., 2021), persistence and retention as well, the results from the LASSI, a study skills inventory that measures skill, will and self-regulation, were evaluated to determine if there was correlation. As a result of the course, outcomes in attitude, concentration, motivation, test strategies and time management were all increased from pre to post-test, and all scores except attitude, concentration and test strategies post-test scores were correlated with higher GPA. Concentration, motivation and test strategies post-test scores were correlated with higher persistence, and no scores correlated with retention alone. Finally, as some research indicates that developmental students are more at risk in online learning (Jaggers & Xu, 2010; Xu & Jaggers, 2013), it is important to evaluate if online coursework disadvantages our developmental students. Students who take the learning strategies

course face to face do have better grades overall, but do not have a significantly higher GPA or persistence and retention rate. Overall, we can recommend that coursework for developmental students has the potential to increase retention and persistence, that effort should be expended on increasing those motivational characteristics and that we should continue to offer the coursework both online and in person with that caveat that grades may be higher in face-to-face coursework.

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Dedication

To my students. You deserve to be here. Stay gritty. And to my children. I pray that if nothing else, the things I have learned will help you all to meet your goals, do hard things and stick with it when things are not easy.

Chapter 1 - Introduction

Developmental education and college success courses are not new phenomena. The first developmental education program was established at the University of Wisconsin in 1849 (Arendale, 2002). Before formal developmental education coursework was established, pre-college tutoring or preparatory schools were necessary to help students pass entrance examinations. Colleges began to differentiate themselves based on their admission exam criteria eventually leading to the establishment of community colleges. The establishment of community colleges (formally in 1902) was in part to help provide resources for underprepared students (Arendale, 2002). Though developmental students often were from lower socioeconomic backgrounds with less access to private tutors and formal education, even wealthy students needed tutoring in Latin and Greek in which Harvard and Yale required proficiency (Arendale, 2002). This is still true today; though higher proportions of developmental education students still hail from lower SES populations (52%), 33 percent come from high SES brackets (Chen & Simone, 2016). Since the first remedial coursework started, college reading and study skills classes have increased exponentially. 350 colleges were offering coursework in how to study by 1909. By 1929, over a quarter of schools offered remedial coursework, and presently, the majority do (Arendale, 2002; Hutchins & Ganga, 2019). A common perception might be that developmental education and college success coursework are relatively new to higher education; however, that is hardly the case. Rather, the format and type of coursework offered have evolved to meet the needs of students.

Developmental education has gone through many iterations from tutoring programs to reading coursework to full-fledged programs in remedial skills (Arendale, 2002). Each of these iterations have, at their heart, a mission to provide access to a college degree by offering the

necessary skills and foundational information students need to excel. Though college success coursework is in many ways foundational, it is no longer in vogue as other developmental reforms have taken precedent (Rutschow et al., n.d.). Though these reforms are showing promise and should be pursued, in education we are often guilty of the panacea du jour, moving onto the newest, flashiest ideas and abandoning anything that came before. In this case, throwing success courses to the wayside in pursuit of more dramatic reforms. That is not to say that success courses are no longer offered. However, though they showed promise, their potential may not be fully realized. Many colleges offer success courses, but few require it, though it could have positive impacts on their other academic outcomes.

Often literature about developmental education students notes the impact of personal skills such as motivation, time management and study strategies (Fish & Wickersham, 2009; O’Gara et al., 2008; Jaggars & Bickerstaff, 2018; Kimbark et al., 2017; Xu & Jaggars, 2013). The literature suggests that these skills may also be mitigating factors in developmental education students’ pursuits of higher education. As such, it would be useful to determine if altering these personal skills would also alter developmental education students’ outcomes in terms of GPA, persistence, and graduation rates. The idea is to use these courses in conjunction with other promising reforms to mobilize more dramatic outcomes for students.

Demographics of Community College Students

The community college environment is set apart from that of four-year institutions due to a variety of factors, particularly the characteristics of students that tend to enroll. Some notable characteristics of community college students are an average age of 28, a majority are enrolled part-time rather than full-time, many are first generation college students and many care for dependents (American Association of Community Colleges, 2020; Beer, n.d.; Center for

Community College Student Engagement, 2014). Non-community college students are more likely to attend full-time (44% vs 25%), be within the traditional age range of 18-24 years, and are less likely to be first generation students (Aud et al., 2021; Beer, n.d.). Part-time enrollment is correlated with lower completion rates (Lang et al., 2021). As many parents report spending over “20 hours a week” caring for dependents (a part-time job in itself), access to adequate childcare can increase completion rates for those with dependent children (Gault & Cruse, 2017). First generation students are also at a disadvantage; 27% of first-generation students graduated within four years as compared with 42% of their counterparts (DeAngelo et al., 2011). Additionally, two thirds of community college students are required to enroll in development courses, adding more time to completion (American Association of Community Colleges, 2016). All these factors combine to contribute to the unique challenges of community college education.

Retention, Persistence, and Graduation Rates

Graduation rates or completion rates are a typical measure of student success. The recent College Transparency Act as well as the earlier Student Right-to-Know Act will require graduation or transfer rates to be reported (Jaschick, 2022; *Student right-to-know and campus security act*, 1990). The Student Right-to-Know Act measured graduation rates by the number of students who complete their program of study within 150% of the expected timeframe (*Student right-to-know and campus security act*, 1990) and most reporting follows this lead. Two-year college completion rates have been lower than those of their four-year counterparts; A report by the National Student Clearinghouse Research Center (2020) found that 40.2% of community college students earn a credential within six years whereas the overall average is 60.1%. This report tracks students across institutions to determine either associate’s or bachelor’s degree

completion at any school. Other reports indicate the number of community college graduates to be closer to 33% though these reports often do not account for transferring students (National Center for Education Statistics, 2020). Completion rates are also lower for Black and Hispanic students, which is particularly relevant as these ethnicities are more likely to be represented in developmental education (Chen & Simone, 2016).

Individual institutions are particularly interested in retention rates as these rates demonstrate the student's dedication and persistence at one institution rather than across institutions. Often, retention rates can reflect on an institution's quality of support services and college integration, providing information for colleges about where they are succeeding and where there are gaps. Retention rates are also resting at about 63% for two-year students (Irwin et al., 2021). This is lower than four-year students (81%), but since transferring is counted as non-completion (in the National Center for Education Statistic's study, 2020) and since many students enter two-year institutions with the intention of transferring, retention rates for CCs may be misunderstood. However, students who start at two-year institutions are 15 to 20% less likely to finish a bachelor's degree, twice as likely to take more than six years to complete their degree, and 20 to 30% more likely to reduce their degree aspirations than their four-year counterparts which can impact these rates as well (Pascarella & Terenzini, 2005). Pascarella and Terenzini (2005) note that there are some studies that do not confirm this, but that these are the minority; the bulk of evidence indicates that these tendencies to drop out, delay completion and reduce aspirations are overall disadvantages for CC students.

Persistence (students' continued enrollment in any higher education institution) is more difficult to track than retention. As the National Center for Education Statistics (Irwin et al., 2021) notes, often these students who transfer are marked as non-completers which inadequately

accounts for persistence to graduation. Pascarella and Terenzini (2005) also indicate that transfer itself reduces the odds of obtaining a bachelor's degree, which is particularly problematic for two-year college students with these aspirations.

GPA is an important metric to include since it often is correlated with students' eventual degree attainment (Pascarella & Terenzini, 2005). Though there is widespread debate on the merit of grades and their accurate reflection of knowledge, GPA is still an indicator of "general intellectual capabilities," "academic skills" and "personal traits" (Pascarella & Terenzini, 2005, p. 396). No matter what GPA is intending to or is actually reflecting, the correlation between GPA and persistence is strong: "Virtually without exception, students' grades make statistically significant, frequently substantial, and indeed often the largest contribution to student persistence and attainment" (Pascarella & Terenzini, 2005, p. 397). Some evidence suggests that the first-year grades are particularly impactful and that good grades reduce dropout behavior for first years (Pascarella & Terenzini, 2005). Therefore, GPA is an important variable to track along with persistence and attainment.

Developmental Education Demographics

According to the National Center for Education Statistics, in the 2011-12 school year, 41% of first- and second-year bachelor's degree seeking students at a two-year institution were enrolled in remedial coursework, with an average of three required courses (Chen & Simone, 2016). Black and Hispanic students, students from lower income backgrounds, first generation students and female students were more likely to be enrolled in remedial coursework (Chen & Simone, 2016). Students with a GPA lower than 2.5 or those deemed to have weak academic preparation were more likely to be enrolled in remediation as well. However, the report notes that remediation is widespread even among higher income demographics, students with college-

educated parents and even students admitted to selective universities. Chen and Simone (2016) note that this could be due to a “misalignment between college and high school standards” or a reflection on the types of assessments used to assess the need for remediation (p. vi).

Remediation is designed to help students become successful in college level coursework, but there is debate as to its efficacy. For instance, the problem with remediation is that it increases students’ time to reach graduation. The Department of Education cites a study that indicates that developmental education, first time, full-time students are 74% more likely to drop out and that only 10% finish on time (Schak et al., 2017). However, other research indicates that while developmental education may increase time to completion, those who forego remediation when it is needed are less likely to graduate as well (Hodara & Jaggars, 2014). Therefore, the debate as to developmental education’s merits continues to rage.

Meeting the Needs of Developmental Learners

Part of the debate about the merits of developmental education also encompasses a debate about how best to reach the needs of developmental students. Recent reformers advocate for accelerated programs, limiting courses required, by-passing coursework entirely, summer bridge programs and co-requisite models (Ratledge, 2021). There is also a body of evidence in support of external supports such as academic counseling, financial support, learning communities, tutoring, and courses or seminars to teach college readiness (e.g. Boylan et al., 1997; Goldrick-Rab, 2010; Kolenovic et al., 2013; Rutschow & Schneider, 2011).

A lot of emphasis has been focused on a redesign of courses or sequencing adaptations. Some research on accelerated developmental coursework seems promising, demonstrating that students who take accelerated developmental coursework are 10% more likely to remain enrolled, earn an average of 8 additional credits compared to peers, and 6% more likely to attain

a degree (Mayhew et al., 2016). Other research also supports the potential of these accelerated programs (e.g., Bailey, 2009; Hodara & Jaggars, 2014; Valentine et al, 2017). However, some of the requirements for enrollment in the program evaluated by Mayhew and colleagues (2016) are full-time enrollment and completing a college success course, both of which have been linked to positive impacts on community college students' credit attainment (Goldrick-Rab, 2010) and retention (Crisp & Taggart, 2013). Similarly, research has shown that students who co-enroll in developmental, non-credit courses as well as credit bearing courses are more persistent (Fowler & Boylan, 2010).

Current research and reforms in developmental education are inundated with accelerated and co-requisite programs (Ratlidge, 2021). However, evaluating the efficacy of this work is still in progress. For example, a lot of the current research on developmental education stems from the City University of New York (CUNY) ASAP (Accelerated Study in Associates Programs) reforms, and the reforms undergone in the state of Florida (Park-Gaghan, 2020). After the first wave of reforms focused on providing supports such as tutoring, college success courses and advising, the second wave sought to fundamentally alter the ways that students are placed and the way that developmental education is undertaken (Park-Gaghan et al., 2020). However, although these reforms are merited and indicate positive results (Bailey et al., 2015; Kolenovic et al., 2013) we should be cautious about abandoning the first wave of reform: tutoring and supplemental instruction. In fact, the third wave of reform circles back to that initial phase and combines the provision of supports with reformed sequencing in a move to guided pathways. Guided pathways seeks to provide students with clear sequencing toward degree attainment with intensive advising and support systems to aid students' progress (Center for Community College Student Engagement, 2020).

The guided pathways movement recognizes the necessity of providing supports and not just reworking course sequencing. Tutoring and supplemental instruction might also give students who have the option to opt in or out of developmental education just enough of an edge to bypass developmental education. The current emphasis on supplemental supports is focused on advising and financial aid, but college success coursework should be investigated as a method for increasing success and persistence for these populations additionally. The success from the CUNY ASAP program is mitigated by the fact that success coursework is also required for accelerated developmental education students (“CUNY Start Advisement”, 2017). The very fact that the program requires college success coursework should be indicative of its worth. Therefore, as community colleges seek to redesign pathways, space should be made for the inclusion of college success coursework.

College Metrics

Colleges should be particularly invested in promoting the success of all college attendees. Community colleges, as previously noted, serve a diverse population that has different needs than the typical four-year college student. It is likely not surprising that retention rates are highest at the most selective universities (97%) and lowest at those with open admissions policies (61% for open admission universities, 63% for two-year community colleges) (Irwin et al., 2021). It should not be discounted that there are a number of students who view college as an experiment and attempt coursework in order to determine if it is a fit for them (Manski, 1989). Those students are likely attracted to colleges without rigorous vetting and admission policies, likely impacting the retention rates of community colleges.

Universities are concerned with keeping these rates as high as possible since the 1990 Student Right to Know Act and the recent College Transparency Act (2021) has required that

colleges report the number of students who complete their degree on time (150% or 6 years for a bachelor's degree) (*Student Right-to-Know and Campus Security Act*, 1990; *College Transparency Act*, 2021). Because students who transfer are counted as “non-completers,” two-year schools and community colleges also suffer in that metric. While reporting these rates clearly increases transparency and assists decision making for students and parents, the informed, more academically successful (and therefore more capable of being selective) student is likely going to choose the universities that have high retention and graduation rates. This likely skews the metrics and creates further stratification between selective universities and community colleges.

The impact of this is that community colleges will increasingly continue to serve a larger proportion of students who need academic and study skills support. This means that developmental education and supports for students in developmental education are paramount. As developmental students are currently less likely to complete and retain due to the demands of developmental education programs, they will, in turn, bump these retention and graduation rates further down; it becomes a vicious cycle. As such, supporting developmental education students is essential not just because it is ethical to do so, but it is also in the college's best interest to increase these supports to increase developmental education success rates and, in turn, increase the college's overall graduation and retention rates.

Motivation

Motivation is difficult to define as it is context specific and often serves as an umbrella term that includes other concepts such as efficacy and goal orientation. However, since motivation can have a big impact on students' outcomes, it is important to evaluate. Linnebrink and Pintrich (2002) outline the main tenants of motivation, arguing that motivation cannot be

viewed as a simple black and white issue of “motivated” or not. Instead they postulate that there are several types of motivation, and that motivation is not stable but contextual and fluid. They also note that self-awareness is fundamental for individuals to exert control over their own motivation.

There are four core components of motivation: self-efficacy beliefs, adaptative attributions, intrinsic motivation, and goal orientation. *Self-efficacy* or the belief that one is capable of completing a particular task is positively correlated with academic achievement and persistence (Linnebrink & Pintrich, 2002). It is domain specific, and it cannot be a false sense of ability, but must also be accurate. *Adaptative attributions* are beliefs about who is in control of our lives and our ability to effect change (Haynes et al., 2009). Positive attributions refer to the idea that we can change outcomes by our actions: “If I would have studied in smaller chunks, I would have been more effective at retaining information”. This is similar to Dweck’s growth mindset theory (Dweck, 2016) The meta-analysis by Haynes et al. (2009) supports the correlation between motivation and persistence and outlines clear methods for teachers to instruct students in attributional retraining. Their findings indicate that students with low perceived control of their outcomes are likely to benefit most from attributional retraining and effective teaching practices. Additionally, attributional retraining impacted students’ intrinsic motivation, the next component of Linnenbrick and Pintrich’s (2002) four areas. *Intrinsic motivation* relates to our personal interest in a domain or subject and what is driving us to learn and grow in that area. Children often are exemplars of this as they can fixate on a subject, learn as much as they can and retain that information due to extreme interest in the subject. Finally, *goal orientation* measures our desire to achieve a certain outcome and whether we can plan for that attainment. However, goals must be controllable, not measured by comparison with others

but rather against oneself (Linnenbrick & Pintrich, 2002; Dweck, 2006). If a student wants to be the best in the class, that goal is helped or hindered by the peers that happen to be in that class as well. This, of course, leads to negative attributions, hindering students' self-efficacy (Haynes et al., 2009).

Students in developmental education already face additional challenges to enter gatekeeper courses in terms of preparation. Referral to developmental education itself can be demotivational as it can make students who believed they were capable question that belief. Therefore, it is possible that these students are likely to suffer in some of these motivational measures. If students internalize those failures as measures of their own competency or worth, it ultimately creates a self-fulfilling prophecy where they are then more likely to have low locus of control (creating negative attributions), less internal motivation, and less self-efficacy. Therefore, it is important to measure students' relative motivational levels as this may be a mitigating factor in their achievement in college success courses.

Online Courses

In addition to motivation being a mitigating factor, course modality might also impact outcomes. Online coursework often requires certain skills that are often lacking in developmental education students, including time management, literacy, study skills, and application of feedback (Xu & Jaggars, 2011, 2013). There is also widespread debate about the efficacy of online education courses in general (Ebner & Gegenfurtner, 2019; Jaggars & Bailey, 2010; Means et al., 2010; Shachar & Neumann, 2010). According to a U.S. Department of Education meta-analysis, online education is not harmful to students who are prepared for college coursework (Means et al., 2010). However, there is also a lot of research that suggests that

community college students and particularly at-risk populations are harmed by online education (e.g., Jaggars and Xu, 2010; Xu and Jaggars, 2011, 2012).

If this is the case, then it is important to separate out students who are taking online college success coursework from students taking it face to face to evaluate differing impacts. According to Tinto (2006), relationships are also a large component of college success and persistence. If that is so, often students in online courses feel disconnected from their professors. The term for this is social presence or the belief that their professor is a “real person.” Social presence is a factor in student engagement, which can be a factor of persistence (Baum & McPherson, 2019; Richardson et al., 2017). A meta-analysis of studies on social presence indicates positive correlations between social presence and satisfaction and social presence and perceived learning (Richardson et al, 2017). This is consistent with other findings (Berge, 2008; Gunawardena and Zittle, 2009). However, there is not clear evidence that this increases student achievement as studies indicate no growth in some assessments, growth in others and growth that is attributed to social presence from student to student (Hostetter and Busch, 2006; Richardson et al, 2017). Though if social presence increases engagement and engagement increases persistence, logic would dictate that social presence should not be ignored either.

The Case for Further Research

Developmental education students make up a large percentage of two-year college students due to open admission policies. These students are less likely to persist and graduate due to a lack of pre-college skills, a lengthy program of study that does not count towards graduation, a proclivity towards part time attendance (a risk factor in graduation and retention itself) (American Association of Community Colleges, 2022), and the motivational impacts of being so placed (which could be demoralizing in itself). Online coursework could be further

disadvantaging these students who might be drawn to this modality due to its flexibility. Two-year colleges need to increase the graduation and persistence rates of developmental education students, not just for ethical reasons, but also for their own optics, and therefore, recruitment.

Developmental education has undergone multiple waves of reform, but the most recent work has indicated a need for a multi-pronged approach, combining changes in course sequencing, entrance requirements and time commitment with other institutional supports like advising, campus integration and tutoring resources. It is important for colleges to leverage robust academic supports and include college success coursework to complement current reform efforts and help overcome existing developmental coursework hurdles. This type of coursework has significant research support for students overall, could offer a leveling of the playing field and an enhancement to developmental education persistence rates overall. So instead of moving beyond and abandoning this type of intervention, leveraging it further for the aid of developmental education students would be far more beneficial.

Since most colleges already employ college success courses or first year seminars (95% according to Pascarella & Terenzini, 2005), mobilizing college success courses for developmental students would be relatively efficient. At the institution where this study is conducted, these courses are electives and optional for all students except for students who are on academic probation. Though the college success course offered for students on academic probation is still optional, refusing to take it would result in sitting out a semester. There are some schools that follow a similar model, but some require all entering students to take a college success course and some specifically require developmental education students to do so (Coleman et al., 2018; Zeidenberg et al, 2007). So, if college success courses increase persistence, GPA, and graduation rates for students overall despite the current low rates of

persistence for developmental education students, adding college success courses could enhance the efforts of developmental education redesign, not take away from it.

Another argument might be that the point of a redesign is to streamline the coursework developmental education students are already taking, not add another course. However, if students were required to take a college success course, their ability to retain information from coursework might be enhanced. This would be essential for a program design that is fast paced and relatively intensive. In fact, the CUNY Start program (a branch of the ASAP program heralded for their accelerated developmental education) does require a college success course (CUNY Start, 2021). At the institution of study, the course is being offered to developmental education students under a scholarship; so, cost, in this particular instance, is not a factor, though it could be in other institutions.

If college success courses are offered, it would behoove us to know that they work. Though I will review the literature more thoroughly later, Pascarella and Terenzini (2005) note that students in developmental education, first year seminars and student support services programs (similar to college success courses) all positively impact persistence. Though there is debate about how directly or indirectly some of these impacts are (particularly in first year seminars), the bottom line is that they seem to work. With that in mind, it seems reasonable to specifically study the impact of college success classes on developmental education students.

Theoretical Framework

The theoretical framework here consists of a general framework for the integration of college and student, and then a more specific framework on the specific supports needed for students. The general framework is one proposed by Pascarella (1985). Using Chickering's seven vectors of the influence of the college on student performance, Pascarella developed a causal

model that proposes that the environment of the university is formed by both the structures already in place like enrollment selectivity and size as well as the student's background and traits including their readiness and personal traits. The environment in turn impacts the socialization of the students with faculty and peers which impacts the quality of student effort and therefore, their learning. This framework demonstrates the symbiotic relationship between the student and the institution and highlights the importance of examining our student populations to see what strengths and needs these students are bringing to the table and meeting our students where they are.

The second framework is that of Lane et al. (2019) who developed a framework on the dimensions of student success and the supports that impact it. They identify five dimensions of support for learning based on academic data and surveys: connectedness, mindsets, self-management, academic capabilities and professional identity. Connectedness is directly related to belonging, collaboration and networking. Mindsets is grounded in Dweck's work on growth mindsets but includes motivation and problem-solving vectors. Self-management refers to students' ability to use time management, identify and use learning strategies and regulate their social networks. Academic capabilities refers to the skills needed to learn effectively; Lane et al. (2019) notes that these capacities are inextricably linked to outcomes in course content. Professional identity relates to students' sense of ability and identification as someone who can be successful in the career of interest.

These frameworks are integral to this study as the learning strategies courses are a feature of the college environment and as such, communicate an interest in helping students to achieve. Additionally, the small class sizes and flexible nature of the course allow the content to be individualized to meet students' specific needs under the discretion of the instructor. These class

sizes allow for increased potential for connectedness, though the course is not a cohort. The skills that are explicitly instructed are those that would align with Lane et al.'s framework in "academic capabilities". Additionally, the course provides psychological instruction and reflection in modules on growth mindset, metacognition and brain-based learning as well as providing the LASSI self-assessment to allow students to reflect personally on these qualities. Therefore, the framework provides a justification for the value of the learning strategies course as so many of these supports are already embedded, but also supports other ventures of the Academic Support branch such as Career and Life Planning courses, networking fairs, individual and tutoring centers, success coaches, and workshops.

Research Questions

I offer the following premises that will then be supported in the literature review. First, developmental students are often less prepared, and because they are often less prepared, they are often less successful. This lack of success has caused researchers, administrators, and educators to try and remove barriers for developmental education students. One way to do this is by using study skills classes to close the skills gap, increase relationship building among students and increase support services. Study skills classes can increase achievement and persistence, thereby accelerating academic momentum, and ultimately increasing graduation rates. Therefore, college success courses should equally help developmental education students to persist and achieve, even with the disadvantages of developmental education and preparation. I also note that motivation impacts achievement and persistence, and therefore, students with higher motivation scores should demonstrate higher persistence and achievement. It is important to separate out those with high and low motivation to differentiate its impact. Finally, online courses are often more difficult for developmental education students, though overall, they are noted to have

similar outcomes when controlling for readiness. Therefore, it is important to separate out students in online courses versus students in face-to-face courses to see if this has a mitigating impact. Given the above, the research questions for this study are as follows:

1. What is the impact of a one credit hour college success course on GPA, retention and persistence for developmental education students who enrolled versus those who did not?
2. How are psychological traits like motivation, as measured by five LASSI categories, associated with developmental education students GPA, retention and persistence?
3. What is the impact of course modality of a one credit hour learning strategies course on developmental education students' grades, GPAs, persistence and retention rates?

Setting

Large Midwest Community College (LMCC, for future) is the setting of this study. The college is an ideal environment because of the extensive programming offered and specific context of the research with regards to scholarship offerings for developmental education students. In the fall of 2021, LMCC consisted of approximately 16,000 students enrolled in credit bearing courses, approximately 30% of which are full-time students. The average age is 23 and most students are enrolled to continue their credits versus first time college students. Most students intend to get their associate degree or a certificate (about 50%), while some students intend to transfer (about 30%) (*Facts About JCCC*, 2021). Most students are Caucasian, with Hispanic and African American the second and third largest demographics. The graduation rate is approximately 25%, about a fifth of students transfer and only about

15% complete within a 2-year time frame (Institute of Education Sciences, 2021). In a typical year, about 6,000 students are enrolled in online courses (closer to 43%) (YuJa, 2020). The college has an approximately 60% retention rate for full-time students and 40% retention rate for part time students. Full time students are more likely to earn an associate degree, returning students averaging higher likelihood than first time students (Bailey et al., 2006; *Facts About JCCC*, 2021).

The classroom setting will be the learning strategies course, a six week learning strategies course that teaches students about how the brain works, how to take notes over lectures and textbooks, how to preview learning material, and how to study and take tests. The sample of this research is focused on developmental students, some of which take the course for free via scholarship. The scholarship students are those who have been enrolled in developmental education and are graduating from developmental education to their gatekeeper course which they are co-enrolled with the learning strategies course. This can be Math 171, Psychology 101 or English 121. I will specifically be looking at students who are going into psychology or composition since College Algebra students take the Learning Strategies for Math course, which covers different material.

Even within the general population, the students bring a wide range of demographics to the table: adult learners, special education needs, English as a second language students to name a few. The students can choose to take the course fully online asynchronously or in person. Because the course is 6 weeks long, students can take it at the various points in the semester (at the start, late start, midway through etc.) which could have an impact on outcomes, especially if they take it towards the end of the semester and do not have a chance to use the strategies as much. Since the data spans several years, I also will have the variable

of impacts from the differing years that are included; this could specifically be confounding with regards to Covid-19 as some students will be taking the course online that would not otherwise choose to be online and some students who might have otherwise taken a scholarship and the course, may have refrained. Further specificity on the sample for each article will be provided in the methodology.

Chapter 2 - Enrollment and Non-Enrollment in Learning Strategies

Course and Subsequent Impact on GPA, Retention, and Persistence

for Developmental Education Students

Literature Review

Developmental Learners

Developmental learners are those students who are required to take specific skill building courses before enrollment in credit bearing (and often other prerequisite) courses are open to them. Developmental courses are perceived as necessary to accommodate open admission policies at most community colleges. These students are identified (typically) through placement exams. According to the National Center for Educational Statistics, 68% of students in community colleges and 40% of students in four-year schools took at least one remedial course (Chen & Simone, 2016). Goldrick-Rab (2010) claims that as many as 90% of CC students spend a year or less in remedial education. Community college students take, on average, three remedial courses while their four-year counterparts average two courses in total (Chen & Simone, 2016). Minorities, low-income groups, first generation students and older students are disproportionately placed into developmental education (Chen & Simone, 2016).

Jaggars and Bickerstaff (2018) note that most developmental students would benefit from support in time management, strategies for tasks and reading, and notetaking and studying (2018). Research also notes that even students who are academically prepared struggle due to a lack of nonacademic skills like the ones listed above (Karp et al., 2017; Jenkins et al., 2009). In general, there is an assumption that students in developmental education are lacking in college readiness though what that means is not always clear. Usually it means academic skills, which

makes sense because these students are being referred to academic content that is below college level, but there is a parallel assumption that developmental education students struggle in other ways as well (Fish & Wickersham, 2009; O’Gara et al., 2008; Jaggars & Bickerstaff, 2018; Kimbark et al., 2017; Xu & Jaggars, 2013). But there is a wide variance in what that means (study skills, time management, motivation, goal orientation) and widely varying attempts to quantify those interactions.

Because developmental education students are less prepared, they are often less successful than their peers (Jaggars & Stacey, 2014; Rutschow & Schneider, 2011). This is a controversy in developmental education as developmental students are less likely to persist, particularly after their first year (Bailey, 2009; Goldrick-Rab, 2010; Jaggars & Stacey, 2014;). Valentine et al. (2017), using regression discontinuity, found that students who were in developmental education earned less college credits, were 8% less likely to pass the gatekeeper course and were 1.5% less likely to attain a degree or certificate when compared to their peers that were placed in credit bearing coursework. There is debate as to the validity of using regression discontinuity as it limits the population studied to those directly above and below the “cut off” which can leave out students on the margins in both directions (Bailey et al., 2013; Goudas and Boylan, 2013). There is also research that supports that developmental education students have higher graduation rates and persistence rates compared to those who did not enroll in developmental education yet had similar academic characteristics, indicating that the coursework may in fact be necessary for students to be able to succeed in credit bearing coursework (Bettinger and Long, 2005, 2009; Chen & Simone, 2016; Hodara and Jaggars, 2014). Hodara and Jaggars (2014) found that students were 2.5% less likely to pass the gatekeeper courses without enrolling in remedial coursework; they also found that skipping remediation to

move straight to credit bearing courses increases graduation rates by 2.2% begging the question which to prioritize.

The State of Developmental Education

Developmental education has undergone a significant number of reforms in the past few decades. The prevailing opinion is that developmental education in its traditional form is failing students due to lower persistence and graduation rates, higher costs associated with additional coursework and an inequitable dispersion of minorities placed. There are three waves of reform. The first wave focused on support services, bolstering tutoring offerings, advising, learning communities, college success courses (Rutschow et al., n.d.). The second wave focused on changing the way that developmental education was executed. This included accelerated coursework, co-requisites, multiple measures of assessment and other types of sequencing changes (Rutschow et al., n.d.). The third wave has led to comprehensive reform in the form of guided pathways. Essentially, the initiatives from the first and second wave of reform were promising but did not have enough staying power. The solution: integrate these former types of reform with an overhaul of the way that we offer community college to students. Guided pathways has four pillars of implementation. The first is to clarify what path students must take to reach an end goal (Fairfax, 2019). The second is to help students choose and enter a career path. The third pillar is to help students stay on that path, and the fourth is to ensure that students are learning. Pragmatically, this looks like a substantial increase in advising, intentional career exploration, meta-majors (groupings of related majors to develop learning communities or cohorts), and corequisite coursework (Center for Community College Student Engagement, 2020).

In the margins of these guided pathways discussions, there are references to first year seminars, bridge programs, and college success coursework. The idea of guided pathways was to integrate individual reforms that were demonstrating potential but not getting students far enough (Bailey et al., 2016; Rutschow et al., n.d.). The focus, at the moment, is particularly on advising, but there are nods to these skill-based courses and their place in the larger picture. I-BEST, an accelerated program out of Washington State, not only pairs career coursework with remediation in reading and math, but also includes study skills material (Wachen et al., 2010). The CUNY ASAP program, lauded as a pioneer in accelerating graduation rates, offers students an accelerated developmental education program called CUNY Start which also requires a college success course called Advisement (“CUNY Start Advisement-Core Values and Practices”, 2017). What a college success course could and should look like in the landscape of guided pathways is an important question for stakeholders.

College Success Courses as Support Services

College success courses are a popular method of bridging the gap between learners of all skill levels and credit course work. In the literature, these courses go by many different names: college study skills, learning strategies, freshman success, college survival, college 101, college/student success, first year seminars or orientation programs. These programs have a wide variance in what they entail but some commonalities are teaching students study skills, learning strategies, time management, learning styles, how to utilize academic resources and career direction and tools. These courses are offered for credit and not. Some are required for all incoming freshmen or for those on academic probation, while some are completely optional. There is a variance in length as well: some as short as five weeks and others a full semester. In 1996, Cook reported that though most colleges offered orientation programs, only 59% offered a

course that oriented students to the college, despite the fact that these courses affect retention and persistence. Since then, those numbers have risen. In a report in 2015, rates are reported to be as high as 89.7% (Young, 2015).

There has been an increasing body of research that advocates for these courses as a method of increasing persistence, GPA, and graduation rates. Zeidenburg, Jenkins and Calcagno (2007) expanded the research of a formative study from the Department of Education in Florida and examined students who enrolled in success courses controlling for demographic and academic characteristics. They found that students who took success courses were 8% more likely to hold a credential, and even though developmental students tend to lag behind their peers in outcomes, developmental students who took success courses were only 2% less likely to complete a credential than their peers (no matter if their peers were also enrolled in success courses or not). They also found higher persistence and transfer rates for success course enrollees. Community college students in success courses have also had higher GPA/grades, retention, and graduation rates according to other studies (Tuckman & Kennedy, 2011; Kimbark et al., 2017; Fowler & Boylan, 2010). Some studies found positive impacts for retention and mostly positive results for graduation (Crisp & Taggart, 2013; Mann, 2018) but mixed results for GPA. Notably, Crisp and Taggart's (2013) study was a meta-analysis, synthesizing information from 15 or more studies. Robbins et al. (2009), another meta-analysis, delineated the studies into psychosocial determinants, finding that academic motivation (or skills), self-management and socialization impacted retention and academic performance rather than the coursework itself. Some studies found positive significant graduation outcomes (Lang, 2006; Schnell et al 2002-03). Conversely, Rutschow, Cullinan and Welbeck (2012) found positive learning outcomes, but did not find higher rates of retention, number of credits passed or earned nor pass rates.

Similarly, Clark and Cundiff (2011) found that students in the University 101 course (offered at a four-year institution, not a CC) did not have significantly different GPAs or retention rate. Therefore, though there seems to be a clear impact of college success courses, there is little agreement as to what is most impacted and there is some argument that even though there is impact, that impact can fade over time (Kolenovic et al., 2013).

Qualitative measures have indicated that success courses were helpful and increased student motivation and inspiration (Kimbark et al., 2017). Students also reported the course was helpful in increasing their social support through both faculty and peers (Kimbark et al., 2017; O’Gara et al., 2008). Research has indicated that relationship building itself increases retention and graduation as well (Tinto, 2006). Study skills were also highlighted as a positive impact, particularly time management, note taking and decision-making components (Kimbark et al., 2017; O’Gara et al., 2008). O’Gara, Karp and Hughes (2008) conducted an exploratory study using semi-structured interviews from students at two different community colleges that offered success courses. Their research revealed that in addition to positive feelings toward study skills and relationship connections as mentioned above, other positive impacts were the dissemination of information about college resources, career and life goals and major exploration (O’Gara et al., 2008). It is possible that with greater information about college resources, students may feel more connected to the institution which can be helpful in retention efforts. It is also possible that knowing about college resources increases utilization of those resources, which some researchers show impacts GPA, retention, and graduation rates (qtd in Lang, 2006).

Ultimately, there seems to be a positive impact for college success courses though there is disagreement as to what specific outcomes are elevated and for how long. It also seems that the impacts of these learning strategies courses are mitigated by a variety of factors such as

whether the course is required, whether students are working or full-time students, and what course material is emphasized. Therefore, there cannot really be a consensus until we are comparing outcomes from studies that are implementing learning strategies courses in more similar ways with similar populations.

Another factor that seems to impact the generalizability of the results is what outcomes are assessed. Though GPA is rather straightforward, persistence, retention and graduation rates are not. Persistence is defined as continued enrollment in higher education at any institution while retention is defined as continued enrollment at the same higher education institution (Mayhew et al., 2016). Retention is essentially looking at the value of the college itself in the eyes of the students where persistence is measuring the value of “a” college degree or diploma. The problem is that these terms are used interchangeably, but do not measure the same things. If retention is all that a learning strategies course is concerned with (rather than persistence), then the elements of integration and social connectivity are much greater factors than they might be when evaluating for persistence. If students persist, then they are more likely to be dedicated to the outcome overall. Graduation rates are similarly difficult to measure, particularly at the community college level. Graduation rates that only account for students who obtain an associate degree at the community college in question are missing part of the story. Graduation rates measured in this way do not account for students who transfer to a four-year institution or get a certificate (depending on the study and if they have included or accounted for these outcomes).

Research that specifically evaluates college success courses for developmental education students is positive in short term impacts though there is question as to the longevity of the effects. Developmental students who took CS classes acquired more credits than their counterparts (Cho & Karp, 2012; Weiss et al., 2012). In the study by Weiss and colleagues, they

controlled for the self-selection bias via random assignment and still found greater credit acquisition. Barnes (2012) found that students enrolled in a first-year experience course were more persistent as well. Credit acquisition and persistence are particularly important to generate academic momentum (Adelman, 1999, 2006).

In a study by the MDRC, they adapted the CS course to focus on psychosocial and academic outcomes and found positive psychosocial growth but less consistent academic achievement outcomes (Rutschow et al., 2012). They did find that the first cohort had higher GPA, retention, and earned more credits and consider that there may be differences in the implementation. In a similar vein, Karp and colleagues' (2016) qualitative work (over college success coursework for all students) indicated that the way that college success courses were presented organizationally (1 credit hour, housed in advising/support services) impacted the perceptions students had prior to taking the course, and the way the courses were implemented (by advisors and counselors rather than faculty and often lacked application elements) undermined the usefulness of the coursework. The authors found that there is worth in the coursework and focus their discussion on how to optimize outcomes by changing perceptions and the way the courses are implemented. Therefore, it is important that careful attention is paid to how college success courses are offered and implemented.

Ultimately, if college success courses widely offer positive outcomes in the form of grade point average, persistence or attainment and these particular outcomes are particularly lacking for developmental education students, it seems that a logical option would be to offer, maybe even require, these types of courses for developmental education students. If there are particular impacts on persistence or credit acquisition for developmental students and if that allows for

more academic momentum, there is even more merit to offering or requiring this type of coursework.

Summation of Literature

Developmental learners are a subset of students who are particularly served by community colleges. However, educating developmental learners poses specific challenges as well. In addition to being underprepared academically, many developmental learners are minorities (Black and Hispanic), low income, first generation and female (Chen and Simone, 2016). These subgroups are already at higher risk of dropping out. Therefore, developmental learners are a group that could benefit from any assistance in increasing persistence, GPA and graduation rates. As previously stated, college success courses seem to have ultimately positive outcomes in at least one of these categories. If college success courses could help bridge any of these gaps, particularly for developmental students, they would be well worth the effort. All in all, research on college success courses would contribute to the growing collection of information on the efficacy of this intervention to increase persistence, GPA and graduation rates in developmental learners.

Methodology

Sample

The sample is composed of a treatment and control group. The treatment group is composed of seven semesters of developmental education students who were offered and accepted a scholarship to take the learning strategies course for free. These consist of the groups from the fall 2018, 2019, 2020, 2021 and spring 2019, 2020 and 2021 and consist of 152 students total. These students have all passed either Reading 126 or English 099 or 106. The control group consists of students who met the qualification for the scholarship but did not elect to take the course. The limitation is that students who did not take the scholarship have different motivations than those who did. To make the comparison as robust as possible, the comparison group was selected from the students who were eligible, meaning they had graduated from developmental coursework and were enrolling in gatekeeper courses, and a propensity score was generated to match these students on race, age, full or part time status, Pell Grant receipt, GPA the prior semester, gender, and whether they were degree seeking.

The students' age ranged from 16-63 with an average of 22. The sample consisted of 57% female. Race and ethnicity were 42% Caucasian, 21% Hispanic, 13% Black, 6% Asian, 6% International students, 5% not reported, 5% two or more races and approximately 2% American Indian, Alaskan Native or Native Hawaiian or other Pacific Islands. 35% of the sample received the Pell Grant, 93% were degree seeking and 49% were full time the semester of the course enrollment/eligibility. I used t-tests to determine if the sample differed significantly from the treatment group. In three categories, the treatment group indicated significant differences: age, GPA prior and gender, $p < 0.05$. In the treatment group, students had an average age of 24 versus

22 in the control. Additionally, the treatment group had a higher average GPA of 2.82 versus 2.62 and they were more likely to be female at 72% versus the control of 56%.

	Control	Treatment	Total
African-American/Black	0.128 (0.335)	0.118 (0.324)	0.127 (0.333)
American Native	0.00726 (0.0850)	0 (0)	0.00647 (0.0802)
Asian	0.0630 (0.243)	0.0592 (0.237)	0.0625 (0.242)
White	0.425 (0.494)	0.395 (0.490)	0.421 (0.494)
Hispanic	0.210 (0.407)	0.197 (0.399)	0.208 (0.406)
Pacific or Native Hawaiian	0.0113 (0.106)	0.0132 (0.114)	0.0115 (0.107)
International	0.0630 (0.243)	0.0789 (0.271)	0.0647 (0.246)
Not Reported	0.0468 (0.211)	0.0658 (0.249)	0.0489 (0.216)
Two or More	0.0460 (0.210)	0.0724 (0.260)	0.0489 (0.216)
Female	0.556 (0.497)	0.717 (0.452)	0.574 (0.495)
Degree Seeking	0.931 (0.254)	0.961 (0.195)	0.934 (0.249)
Rec Pell	0.347 (0.476)	0.414 (0.494)	0.354 (0.479)
Age	22.10 (5.995)	23.97 (8.893)	22.30 (6.398)
Full Time Enrollment	0.491	0.507	0.492

	(0.500)	(0.502)	(0.500)
GPA Semester Prior	2.619 (0.924)	2.824 (0.903)	2.642 (0.924)
Reenrollment Next Semester	0.642 (0.479)	0.789 (0.409)	0.659 (0.474)
Retain, Transfer or Graduate	0.719 (0.450)	0.829 (0.378)	0.731 (0.444)

Table 2.1. Summary Statistics for Control, Treatment and Overall

Procedure

The following outcomes were collected: students' GPA after taking the learning strategies course, persistence measured by continued enrollment, graduation or transfer rates and retention as measured by continued enrollment the following semester. Propensity score matching was utilized to form a control and treatment group. The equation for the average impact of the treatment on the treated is:

$$ATT = E[Y_{T=1}, P(X)] - E[Y_{C|T=0}, P(X)]$$

Here $E(Y_{T=1})$ is the probability a student received the treatment (taking the course), where $E(Y_{C|T=0})$ represents the counterfactual. $P(X)$ is the propensity score match and E the expected value. The confidence interval was set at .05. I chose kernel matching as some sources (Alcott, 2017; Frolich, 2004) indicated it is more precise especially for this type of facile simulation with a large control to treated ratio, and I did not like the pitfalls of nearest neighbor and common matching. Kernel matching, since it compares the treated to a weighted average of the untreated, seems to be more robust (Caliendo & Kopeinig, 2008). Additionally, this method produced the least bias when testing the match quality. The covariates included were demographic information such as race, gender, degree seeking, income (as measured by whether students qualified for the Pell Grant), and age. Full-time enrollment and GPA prior were also included as

both could be confounding variables since both could result in higher GPA following the course (Bailey et al., 2006; Pascarella & Terenzini, 2005) . The initial sample included 152 students who received the treatment (scholarship) and 1,259 students who were eligible to make up the control.

Propensity scores were checked for common support and for matching quality. The first measure was by running a propensity score test. The covariates were examined for non-significant p-values and a percentage bias for each outcome. Then a two-way line graph of propensity scores for the treatment and control groups was examined and finally a propensity score graph.

Results

Match Quality

After generating propensity scores, the scores needed to be checked to see if they balanced. Using the software Stata, I ran the pscore and probit commands to check for balance. As part of the pscore command, a regression is run, an optimal amount of blocks generated (3, in this case) and each block is compared for balance. As the table demonstrates below, balance was satisfied.

Estimating Match Quality and Balance

The balancing property is satisfied

This table shows the inferior bound, the number of treated and the number of controls for each block

Inferior of block of pscore	Recipient		Total
	Control	Treatment	
0	625	38	663
.1	575	100	675
.2	59	14	73
Total	1,259	152	1,411

Table 2.2. Test to examine the match quality and balance.

The next step is to run a probit regression to check the covariates for balance. I examined the significance of the covariates as significance indicates a skew in the distribution. Therefore, it is better if the covariate is non-significant rather than significant. As Table 3 below shows, most of the covariates are non-significant with the exception of age and gender, which I noted earlier.

Probit Regression for Covariates

Recipient	Coefficient	Standard Error.	p-value	[95% Conf	Interval]	Sig
Black	-.099	.153	.516	-.4	.201	
Hispanic	.008	.126	.952	-.239	.254	
Asian	.008	.199	.967	-.382	.398	
Pacific	-.063	.416	.88	-.878	.753	
International	.115	.189	.544	-.256	.486	
Not Reported	.223	.203	.27	-.174	.62	
Two or More	.287	.196	.143	-.097	.672	
Age	.018	.007	.009	.004	.031	***
Degree Seeking	.361	.218	.098	-.067	.788	*
Received Pell	.083	.101	.409	-.114	.281	
Female	.348	.099	0	.155	.541	***
Full Time	.08	.098	.414	-.111	.271	
Enrolled						
GPA Sem. Prior	.079	.054	.147	-.028	.186	
Constant	-2.502	.309	0	-3.108	-1.896	***
Mean dependent var		0.110	SD dependent var		0.313	
Pseudo r-squared		0.037	Number of obs		1382	
Chi-square		35.059	Prob > chi2		0.001	
Akaike crit. (AIC)		950.626	Bayesian crit. (BIC)		1023.864	

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 2.3. This chart evaluates the significance of the covariates to determine skew

A key assumption of propensity score matching is common support. This refers to the idea that there needs to be considerable overlap between the control and treatment groups. Therefore, I ran a kdensity plot to examine the distributions (see Figure 3 below). The overlap below suggests considerable common support.

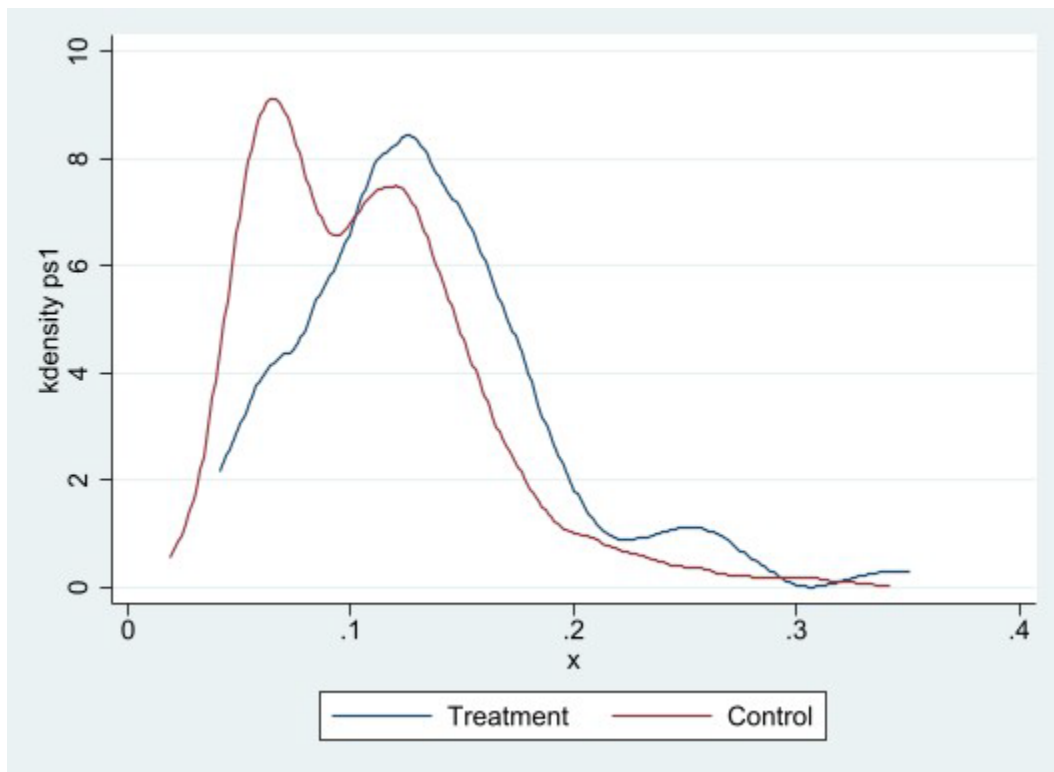


Figure 2.1. Distributions of propensity scores in treatment and control groups.

After estimating the balance, examining the covariates and the common support, I also ran the Hosmer-Lemeshow test to determine if the probit model is effective or if there are confounding variables impacting the model. As Table 4 illustrates, the Prob>chi2 is insignificant which indicates a good fit.

Probit model for Recipient, goodness-of-fit test
(Table collapsed on quantiles of estimated probabilities)

Hosmer-Lemeshow Test of Goodness of Fit

Group	Prob	Observed Frequency	Expected Frequency	Observed Frequency	Expected Frequency	Total
		1	1	1	1	
1	0.054	6	6.2	133	132.800	139
2	0.063	9	8.1	129	129.900	138
3	0.073	6	9.4	132	128.600	138
4	0.090	12	11.200	126	126.800	138
5	0.106	12	13.500	126	124.500	138
6	0.118	20	15.500	119	123.500	139
7	0.130	14	17.100	124	120.900	138
8	0.146	19	19.000	119	119.000	138

9	0.172	26	21.800	112	116.200	138
10	0.351	28	30.000	110	108.000	138
number of observations =		1382				
number of groups =		10				
Hosmer-Lemeshow chi2(8) =		4.92				
Prob > chi2 =		0.7663				

Table 2.4. Hosmer-Lemeshow goodness of fit model to determine how variables impact the model.

Another assumption of propensity score matching is selection is based on observables, and conversely that there are no unobserved characteristics missing from the model. This is, unfortunately, difficult or impossible to prove. There are likely differences between the two samples in that one group was motivated to take the proffered course while the other was not. However, including GPA the semester prior serves as a proxy variable for motivation as GPA and motivation are often correlated (Almalki, 2019; Fong et al., 2021; Haynes et al., 2009; Taylor et al., 2014). This is also why the Hosmer-Lemeshow goodness of fit analysis is important. Even with this, I am making an assumption that the observables are adequately covering all important factors.

Match Regressions

After generating propensity scores on the covariates, I ran a propensity score matching analysis to determine if the treatment and control groups had statistically different outcomes for GPA the following semester. After matching and allowing for missing data (students who did not retain did not have GPA available), the treatment group was reduced to 120 and the control to 792 students for GPA the following semester. The effect of the treatment on the treated indicates only a .019 difference in GPA after matching, and the t-statistic is 0.260 indicating a p-value of 0.80 which is highly insignificant (Table 5).

Variable	Sample	Treated	Controls	Difference	Standard Error	T-statistic
----------	--------	---------	----------	------------	----------------	-------------

GPA After	Unmatched	2.844	2.731	0.113	0.074	1.530
	ATT	2.844	2.825	0.019	0.074	0.260
Note: S.E. does not take into account that the propensity score is estimated.						

Table 2.5. Regression between control and treatment group to determine impact of course on GPA the following semester.

The same procedure was used to determine if the other outcome variables, retention the following semester and persistence (whether the student remained enrolled, transferred or graduated), were significant using propensity score matching. For retention and persistence, the treated was 152, the full sample, and the control was only reduced to 1, 245. For retention, the t-statistic is 3.74 which indicates a p-value of less than 0.01. This indicates a highly significant correlation between retention and recipients enrolled in the course as course takers are 14% more likely to remain enrolled.

Propensity Score Matching Regression for Retention

Variable	Sample	Treated	Controls	Difference	Standard Error	T-statistic
Persist Next Term	Unmatched	0.789	0.643	0.146	0.041	3.600
	ATT	0.789	0.654	0.136	0.036	3.740
Note: S.E. does not take into account that the propensity score is estimated.						

Table 2.6 Regression between control and treatment group to determine impact of course on retention the following semester.

Persistence was also significant. The t-statistic is 2.9 which indicates a p-value less than 0.01.

Students who received the scholarship were 10% more likely to persist than those who had not as indicated by the difference below.

Propensity Score Match Regression for Persistence

Variable	Sample	Treated	Controls	Difference	Standard Error	T-statistic
Retain, Transfer,						

Graduate	Untreated	0.829	0.720	0.109	0.038	2.880
	ATT	0.829	0.731	0.098	0.034	2.900
Note: S.E. does not take into account that the propensity score is estimated.						

Table 2.7. Regression between control and treatment group to determine impact of course on persistence, retention and graduation the following semester

Evaluating the Quality of the Match

After running the matching regression, I checked to make sure that the match has common support again and that bias has been reduced. I do this by visually evaluating the match using psgraph, and more accurately using the pstest command to evaluate the bias of each covariate. For the GPA the semester after outcome variable, the results are demonstrated in Figure 2 and

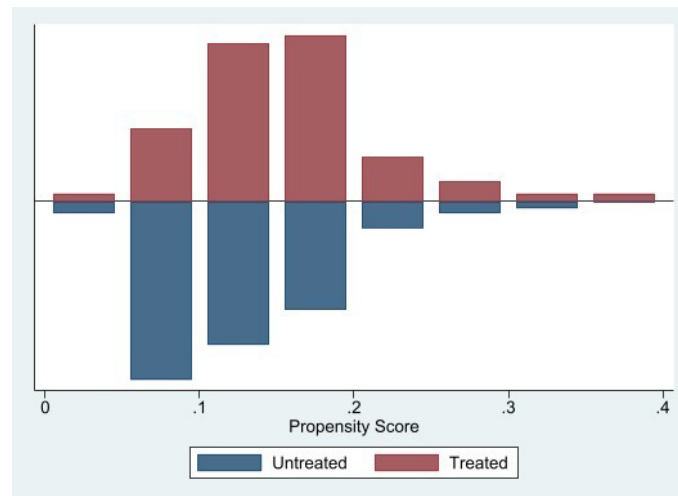


Figure 2.2. Balance of Untreated and Treated for GPA After

Test of Bias for Covariates for GPA After

Variable	Mean			T-Test	
	Treated	Control	%bias	T-Statistic	p>t
Black	.1	0.104	-1.400	-0.110	0.913
Native American	0	0	.	.	.
Hispanic	0.217	0.215	.4	0.030	0.974
Asian	0.067	0.067	-0.100	-0.010	0.991
Pacific	0.017	0.016	.2	0.020	0.986
International	0.067	0.069	-1.000	-0.080	0.939
Not Reported	0.075	0.076	-0.200	-0.020	0.987
Two or More	0.067	0.054	5.9	0.420	0.675
Age	23.733	23.021	9.5	0.690	0.493
Degree Seeking	0.967	0.967	-0.400	-0.030	0.972

Received Pell	0.425	0.424	.1	0.010	0.991
Female	0.717	0.711	1.2	0.100	0.921
Full Time	.55	0.556	-1.200	-0.100	0.924
Enrollment					
GPA Sem. Prior	2.928	2.891	4.5	0.350	0.724

* if variance ratio outside [0.70; 1.43]

Table 2.8. Test of bias for the covariates for GPA the following semester.

For retention and persistence, the results were identical as the samples were also identical. Those results are found in Figure 2.3 and Table 2.9.

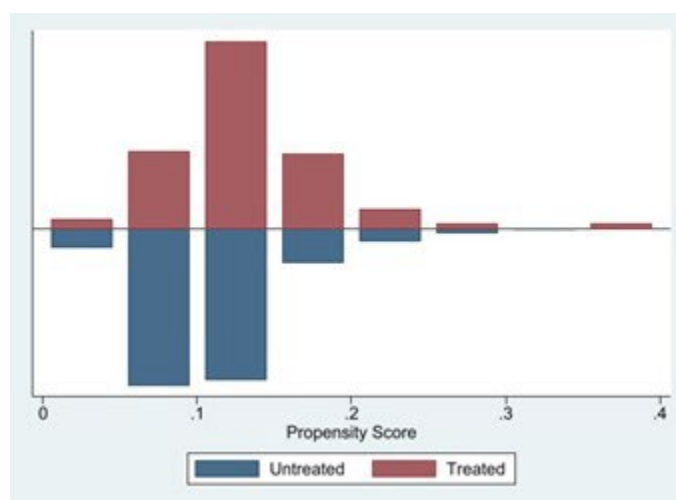


Figure 2.3. Balance of Untreated and Treated for Retention and Persistence

Test of Bias for Covariates for Retention and Persistence

Variable	Mean		t-test		V(T)/	
	Treated	Control	%bias	T-Statistic	p>t	V(C)
Black	0.118	0.125	-2.100	-0.190	0.852	.
Hispanic	0.197	0.203	-1.500	-0.130	0.897	.
Native American	0	0	.	.	.	.
Asian	0.059	0.060	-0.200	-0.020	0.985	.
Pacific	0.013	0.013	.3	0.020	0.980	.
International	0.079	0.071	3.1	0.260	0.792	.
Not Reported	0.066	0.065	.3	0.030	0.979	.
Two or More	0.072	0.062	4.4	0.360	0.720	.
Age	23.967	23.041	12.200	1.010	0.315	1.59*
Degree Seeking	0.961	0.960	.2	0.020	0.981	.
Received Pell	0.414	0.411	.7	0.060	0.953	.
Female	0.717	0.697	4.2	0.390	0.700	.
Full Time	0.507	0.512	-1.000	-0.090	0.931	.
Enrolled						
GPA Sem. Prior	2.824	2.676	16.200	1.400	0.161	0.940

Table 2.9. Test of bias for the covariates for retention and persistence.

Age has a higher bias for both models than the standard less than 5% rule, but is balanced by the other covariates. GPA prior has a 16.2% bias for retention and persistence but removing it and generating a separate pscore results in an unbalanced pscore. As GPA is less relevant for this outcome than it is for GPA after, I will continue to include it but with the caveat that though statistically insignificant, there is more bias here than in other covariates indicating a slight skew in the distribution between the two groups. Overall, balance after matching is well distributed.

Discussion

Overall, the results indicate that, when matching students using demographics and academics, finances and attendance patterns, GPA is not significantly different for developmental students who took the learning strategies course and those who did not. These students are all in the same academic stage, that of graduating from developmental coursework to gatekeeper courses, and seem to be a group that could benefit from learning additional strategies to excel in their courses. However, either the course does not effectively increase students' GPA outcomes or the coursework does not do enough at this particular moment in their academic career.

The results also indicate that when matching students on the same covariates retention and persistence are significantly increased. For both outcomes, the significance is $p < 0.01$. Students who took the scholarship and the course were 14% (coefficient of 0.14) more likely to remain enrolled the following semester and 10% (coefficient of 0.1) more likely to remain enrolled, transfer or graduate (labelled persistence). Multiple regression analysis on the same variables indicates similar significance levels (less than $p < 0.01$) and similar coefficients, though slightly smaller. See Appendix A for outcomes.

Therefore, the conclusions that we could draw here are relatively straightforward. The learning strategies course cannot be depended upon to increase GPA for students in these at-risk populations, but could be a meaningful way to increase students' retention and persistence, which could have larger long-term impacts. As such, it is possible that the strategies taught have the psychological impact of increasing students' confidence in their abilities, as they have tools and resources to utilize, which in turn increases their motivation and determination to see college through. It is also possible that the course promotes belonging and connection which increases

retention and persistence. However, the research on modality in Chapter 4 shows no significant correlation between students who take the course online and face to face and either persistence or retention. Though it is possible that the online course still creates a sense of social presence that promotes belonging, it is typically asynchronous which would make this more unlikely. As such, I find the likely conclusion to be that the course itself increases students' sense of self-efficacy and confidence which in turn lead to continued enrollment and persistence (of Lotkowski et al., 2004). Goal orientation has been linked to self-efficacy as well, which could support this theory (Hsieh et al., 2007), and some research links self-efficacy and belonging, indicating it could be both (Freeman et al., 2007).

Conversely, it is important to evaluate if there are methods for increasing GPA outcomes related to taking the course and whether the disconnect is in the strategies themselves or in the way they are applied. It would also be useful to compare outcomes for students enrolled in the learning strategies course with those enrolled in the three credit, semester long success course. That course also includes the learning strategies but also includes further resources and connectedness and as such, would be an interesting comparison point. A study of other community colleges that employ a one credit hour course in learning strategies could also be useful further research.

Chapter 3 - Motivation as Measured by the LASSI for Developmental Education Students in a Learning Strategies Course

Literature Review

Introduction

Could students who are sorted into developmental education have a negative sense of motivation and self-efficacy due to their placement? If so, this is particularly problematic if students are misplaced due to an overreliance on placement tests (Jaggars and Stacey, 2014; Valentine et al., 2017). If those who do not need remediation are required to take additional coursework than they planned, there could be negative impacts to those students' sense of self, growth mindset and motivation. Therefore, there is a push for using multiple measures to reduce misplacement, especially since standardized exams do not clearly correlate with student success according to many researchers (Hodara & Jaggars, 2014; Valentine et al., 2017). (Carpenter and colleagues (2004) do find there is a correlation, however.) Research has found that students who are misplaced are at greater risk for negative psychological impacts, including less likely persistence (Hodara & Jaggars, 2014). The belief is that students placed in developmental education who did not believe they were academically deficient could instead internalize that placement as part of their academic identity, leading to feelings of inadequacy and therefore less persistence and commitment (Hodara & Jaggars, 2014).

Among students who are referred to developmental education, 30% simply did not enroll at all (Bailey et al, 2010). This indicates that simply the referral to developmental education might be enough to discourage students. According to Bailey and colleagues (2010), 33-46% of students who start their developmental education sequence finish it. Additionally, 60-70% of students who failed to complete their sequence (all the courses necessary for "graduation" out of

developmental education) were successful in the courses in which they did enroll, indicating that passing the course was not the issue as much as motivation to complete the sequence (Bailey et al., 2010).

Motivation

Research on motivation is prevalent in the field of educational psychology as motivation seems to be the elusive factor that can mean the difference between completion and attrition. Linnebrink and Pintrich (2002) outline several types of motivation: self-efficacy, attribution theory, goal orientation and intrinsic motivation. These can be summarized as the beliefs that one is capable, one has power over one's outcomes, one has something one is working towards and one is interested in the content. Research has indicated that motivation is correlated with many external outcomes such as GPA and persistence (Almalki, 2019; Fong et al., 2021). Moore (2007a) found that developmental students who were higher performing also had higher self-efficacy and learner beliefs than other developmental students as measured by the MSLQ (motivated strategies for learning questionnaire). This indicates that self-efficacy and learner beliefs (attribution) could be correlated with better academic outcomes. In another study, Moore (2007b) measured outcomes by analyzing class attendance and extra credit work. Though most students indicated that they would attend the majority of classes and do extra credit work, most ultimately did not. This is useful as it moves beyond the self-report measures and measures actions. Thomas and Higbee (2000) did a combination of self-report and action metrics. They found that attendance, hours spent on homework and attitudes regarding academic autonomy impacted student success, confirming the findings of both of Moore's studies. Wernersbach et al. (2014) also found that developmental students enrolled in college success courses showed

greater increases in self-efficacy as measured by the CSEI (Cooper Smith Esteem Inventory) and the MSLQ than typical students not enrolled in the success course.

A meta-analytic look at attribution retraining notes that by altering mindset in students who have low perceived control, these students demonstrated higher GPAs (Haynes et al., 2009). Other meta-analyses support these findings as well, though caution that practically there are some difficulties to enacting this type of intervention (Siegel Robertson, 2000; Försterling, 1985). Research in this vein indicates that belief in their own ability will impact a student's mindset which can impact other outcomes.

Goal orientation and self-efficacy seem to be intertwined. In a meta-analytic study, Payne and colleagues (2007) broke goal orientation into subsets: learning goals, prove goals and avoid goals. Learning goal orientation, they found, was higher in more efficacious individuals. The connection between self-efficacy and goal orientation seems to be strong, which makes sense as only students who believe they can effect change in their outcomes will attempt to do so. Students with higher self-efficacy tend to have stronger positive goal orientation (as opposed to performance avoidance goals) (Hsieh et al., 2007), and there are correlations between self-efficacy, goal orientation and grades (Caraway et al., 2003; Hsieh et al., 2007).

Teachers have long noticed the impact of intrinsic motivation on student outcomes but trying to quantify and measure that has been more difficult. In a meta-analysis, Taylor and colleagues (2014) found that intrinsic motivation (measured by the Academic Motivation Scale) was consistently related with academic success. This is true for underrepresented groups and other cultural contexts as well (Areepattamannil, 2011; Ayub, 2010; Trevino & DeFreitas, 2014).

So, all four of the components of motivation have important impacts on student psychosocial and academic outcomes. As such, determining if those motivational characteristics

are correlated with outcomes for developmental students and if those outcomes differ from their more traditional peers is important.

Motivation and College Success Coursework

So, can we increase motivation by utilizing college success (learning strategies) courses? Does teaching students a different way of thinking and giving them a tangible skillset to use in their academic coursework increase their motivation to achieve in college? In the learning strategies course, students are asked to examine their mindset and metacognition, and students are taught how to prepare for class, read material, listen to lectures, and take exams. Ultimately, the course is designed to help students to gain some strategies for learning which will hopefully increase their GPA (or at the least pass rates) which will hopefully lead to more retention and persistence and ultimately higher graduation rates. Since we know that self-efficacy and attributions can be a factor in achievement, it is important to determine if this coursework has the potential to increase those psychosocial outcomes as it did in Wernersbach and colleagues' study (2014). In similar research Rutschow and colleagues (2012) found that when they adapted a college success course to focus on psychosocial awareness and academic achievement, they were largely successful in impacting students' "self-management, interdependence, self-awareness, interest in lifelong learning, emotional intelligence and positive engagement in college" though it did not impact their self-motivation, use of resources or sense of responsibility (p. 27).

These psychosocial outcomes have the potential to increase other metrics as well. Robbins and colleagues (2009) in a meta-analysis on the impacts of academic interventions delineated studies into psychosocial determinants, the result of which was that academic motivation (or skills) was likely to have the strongest correlation to academic performance while self-management and socialization had the largest correlation to retention. These results are

similar to the findings of Lotkowski et al. (2004) who found that academic confidence, goal setting, commitment to the institution, social support and involvement positively impacted retention, and Martin (2014) who found that goals, motivation and drive, time management and self-empowerment were common among graduates. Thomas and Higbee (2000) also found that the motivation to learn, a type of intrinsic motivation, increased academic outcomes (higher grades and test scores) for developmental math students. If academic outcomes and retention can be impacted by motivation, self-management and socialization, it is important to consider if college success courses can increase these psychosocial components.

Belonging Impact on Motivation

Motivation can be impacted by several factors. Upbringing, sense of belonging, and positive experiences can impact how students view their self-efficacy and can inhibit or create a growth mindset. One of the factors that can impact motivation is a sense of belonging. In a study by Freeman and colleagues (2007), the authors found correlations between a sense of course belonging, higher motivation and self-efficacy, which has important implications for the culture of the classroom as well as correct placement for developmental students. This is similar to other findings that emphasize the impact that the classroom climate can make on belonging, which in turn impacts achievement, motivation and engagement (Zumbrunn et al., 2012) and which can predict persistence as well (Gopalan & Brady, 2020). A sense of belonging for diverse students can also positively impact their academic efficacy and their beliefs about achievement (Browman & Destin, 2016).

Growth Mindset, Grit and Metacognition

Growth mindset and grit have garnered a lot of attention in recent years due to their potential to help students change their attitudes and beliefs, create higher levels of motivation

and ultimately increase persistence and achievement outcomes. Interestingly, a number of recent research fails to find a broad scale correlation between growth mindset and other outcomes (Broda et al., 2018; Brysacz, 2017; Fooladi, 2022; Kim et al., 2022; Lai et al., 2018). However, for Latinx students, higher GPA outcomes were correlated with higher growth mindset but it seems isolated to this subgroup (Broda et al., 2018; Kim et al., 2022). There is additional research that does continue to confirm the findings of Dweck and Ducksworth (Broda et al., 2018; Hacisalihoglu et al., 2020; Yeager et al., 2019). Then there are studies whose findings are mixed (Burnette et al., 2020; Tang et al., 2019). One study sought to separate growth mindset and grit and determine if either worked as a mediating factor for the other (Tang et al., 2019). They found that grit did increase achievement and engagement in eighth graders and that this was predicted by goal setting but not by growth mindset. Grit's "perseverance of effort" factor does seem to be useful in predicting end of semester grades, motivation and achievement but these impacts are rather small and often are only significant if not controlling for earlier grades (Muenks et al., 2017; Steinmayr et al., 2018).

Metacognition has been correlated with higher GPA and course grades (Young & Fry, 2008). Research about metacognition indicates that metacognition may be an intermediating variable (Gul & Shehzad, 2012). Metacognition has been correlated with positive goal orientation which then can demonstrate increased academic achievement (Gul & Shehzad, 2012) or the utilization of study strategies (Vrugt & Oort, 2008). The study strategies in Vrugt and Oort's (2008) study include goal orientation, monitoring and executing their study process. This study emphasizes the need for metacognition instruction in courses whose mission is to teach students how to plan for, monitor and effectively learn and study. Both growth mindset and metacognition are interlinked with some other measures of motivation. For example, self-

efficacy, as a belief about one's capability, is another form of growth mindset. Goal setting and responsibility can also be linked to metacognition as each requires that the student monitors their own actions and the resulting impacts. It is possible the research on grit and growth mindset is not directly indicating academic achievement because they are intermediating variables rather than independent variables.

The LASSI Assessment, College Success Courses and Motivation

There are a variety of assessments meant to measure motivation. One of those is the LASSI. LASSI stands for Learning And Study Strategies Inventory and includes three overarching scales of measurement and ten subcategories. The three scales are skill, will and self-regulation. Skill is meant to measure how students react to and integrate new information and utilize that on exams. The subscales in this category are information processing, selecting main ideas and test strategies. These items are measuring whether students are aware of how to use these skills in their coursework. The second category is will. This is directly associated with motivation; It measures how intrinsically motivated students are to learn, how they feel about college, their self-discipline, and their effort. The subcategories for will are motivation, attitude, and anxiety. The final category is self-regulation which is measuring how students utilize time and how persistent and focused they are. The subcategories are concentration, time management, self-testing, and study aids. Goal orientation, attribution theory, self-efficacy and intrinsic motivation (Linnebrink & Pintrich, 2002) are clearly represented in these ten categories. Students who are goal oriented and intrinsically motivated will likely have higher scores in self-regulation. Students' self-efficacy and attribution theory will be reflected in the will category. The skill category will be mediated by students' knowledge of learning strategies, but their use

of these strategies could be directly related to their beliefs about their own ability and their own self-regulation.

The Dunning Kruger Effect

It is important to acknowledge that the LASSI is a self-reported assessment. According to Dunning (2011), people are surprisingly unaware of what they do not know. When faced with acknowledging their lack of knowledge or trying to piece a response together, people often overclaim and utilize what Dunning calls “reach-around knowledge,” prior knowledge that could seem to fit with a topic. They find that most people overestimate their abilities, most believing they are above average. There is, however, a relationship between what people believe about their skill and their actual skill (p. 264). People who perform poorly, do seem to acknowledge that, though inaccurately; Overall they think they would score only 15-20 percentile points worse than the self-reported scores of the top performers (p. 263). Dunning claims that skills for performing well at a task and for evaluating one’s performance are the same. To borrow Dunning’s example, if one does not know grammar, one will not be able to edit either. The result is this: if the Dunning-Krueger effect is accurate, then we would expect poor performers to inaccurately indicate their own ability on the self-reported scores of the LASSI. In addition to inaccurately rating themselves in comparison to their peers, other research has indicated poor performers are also unaware of their own errors as well (Ehrlinger et al., 2008). We would also expect top performers to under evaluate themselves in comparison to others (as they tend to assume if it was easy for them, it must be easy for others too), but this is unlikely to crop up in the LASSI since the questions are evaluating their own behaviors and beliefs and not those in comparison to others.

Summation

Since college success courses teach not only academic skills but also personal skills, it is important to evaluate the impact of motivational characteristics on quantitative outcomes in the form of GPA, persistence and retention. If motivation is correlated with achievement, it is important to see if there is any growth in motivational traits after students are instructed in growth mindset and metacognition as well as in learning strategies and whether that growth impacts quantitative outcomes. Self-efficacy, goal orientation, attribution and intrinsic motivation are all key elements of motivation, and growth mindset and metacognition connect with attribution theory and self-efficacy, but it is important to determine if that is the most important area of focus or if there are other areas such as goal setting that would be more essential. This is particularly important for the course that is the subject of this study since it is only a six-week course, so every week of material has to be efficient and effective but not overly elaborate.

Methodology

Instrument

The tool that I will use is the College LASSI. The test can be taken at the following website: <https://www.collegelassi.com/lassi/>. In 1987, Dr. Claire Weinstein published a book *LASSI: Learning and Study Strategies Inventory* that tests the inventory for reliability and validity. She claims that all subcategories are internally valid and reliable (Weinstein, 1988). There has been some question as to the replicability of those results as often researchers are unable to achieve the same P values, but the LASSI has remained a popular tool. The LASSI is an inventory that measures three areas: skill, will and self-regulation. The skill areas are information processing, selecting main ideas and test strategies. The will areas are attitude, motivation and anxiety, and the self-regulation areas are concentration, time management, self-testing and using academic resources. The areas I intend to analyze are mixed: motivation, test strategies, attitude, time management and concentration.

The LASSI is already being used and paid for by the college. That allowed for a larger amount of data to be collected. The test is also considered to be internally consistent, valid, stable and ultimately reliable (Weinstein, 1987; Perkins, 1991; Fong et al., 2021). Fong et al. (2021) note that there have been both strong positive associations (Khalil et al, 2020) found as well as nonsignificant findings (Flowers et al., 2012). There have also been mixed results when delineating between subscales. Perkins (1991) believes it to have low predictive validity, except for the section on motivation, and Zhou et al. (2016) found that four areas are reliable: concentration, motivation, time management and test strategies. In Fong et al.'s (2021) meta-analysis, they found that motivation was the most significant indicator of GPA outcomes alongside test strategies, attitude, time management and concentration. Fong et al.'s (2021) meta-

analysis was the reason that I chose those subscales for analysis. It also represents each category: skill, will and self-regulation allowing for a holistic picture of the student. Though anxiety and selecting main ideas were found to correlate with test scores, since GPA was my primary outcome of interest, I chose to remain focused on the categories that related specifically to that. One thing I will need to be cautious about is a study that found that the LASSI was potentially unstable for at-risk students (Flowers, 2003). However, the author notes that the intervention utilized is likely to have impacted these scores and more importantly, this study was not conducted on the most recent version of the LASSI, published in 2016. It is also why another look at the LASSI with at risk students would be beneficial.

Sample

Participants are students who have taken Learning Strategies from Spring 2018-Fall 2021 (N=365). Developmental students are the population of interest and are different from general education students as these students have taken one or more courses in the developmental education sequence which do not bear credit. As such, their motivation might be substantially different from students who are generally enrolled. Race, gender, age, Pell grant status, full/part time enrollment and degree seeking demographics are included to control for those variables. Students included in the study have data available in all the data points: LASSI scores in all five categories, and GPA during and after the course(if re-enrolled), and retention. Students who have a pre and post test score (N=264) will be evaluated separately from those who only have a pretest score (N=354), indicating they did not complete the course or failed to meet the requirements of the course to complete a post-test. These students will not be excluded though as non-completers give valuable information about a student's motivational traits. When the students had more than a pre and post-test score (three or four or in one case six), the scores were examined individually.

In the case of three scores, the second score was a student who took the test at some point after the first attempt but before the six-week course had elapsed. Sometimes this second attempt came minutes or hours after the first, indicating that the student might have believed the first score was not recorded and attempted it again. In these cases, the second score was removed as it was neither a true pre-test nor post-test. In the case of the four scores, it is possible the students took the LASSI in another course from the department. Using the enrollment date for the learning strategies course, I matched the scores with the semester the student was enrolled and eliminated the other score. The one student who had six scores had a mix of these two situations. In Figure 12, there is a detailed account of the make up of the sample.

Summary Statistics for LASSI					
	<i>N</i>	Mean	sd	min	max
Scholarship?	354	.3757062	.4849902	0	1
Degree Seeking	354	.8954802	.3063667	0	1
Received Pell	354	.3502825	.4777336	0	1
Black	354	.0960452	.2950703	0	1
American Native	354	.0028249	.0531494	0	1
Asian	354	.039548	.1951706	0	1
White	354	.4858757	.5005079	0	1
Hispanic	354	.1610169	.3680668	0	1
Pacific	354	.0056497	.0750581	0	1
International	354	.0762712	.2658072	0	1
Not Reported	354	.0451977	.2080316	0	1
Two or More Races	354	.0875706	.2830695	0	1
Face to Face	354	.5649718	.4964624	0	1
Course Grade	328	2.865854	1.422942	0	4
Female	354	.6666667	.5067998	0	3
Retain	354	.8418079	.3654375	0	1
Retain, Persist or Grad	354	.8954802	.3063667	0	1

Table 3.1. Summary of developmental students included in the sample.

Procedure

First, I ran paired t-tests to determine if pre-test and post-test scores in each category of the LASSI (attitude, concentration, motivation, time management and test strategies) were inherently different; then developmental education and non-developmental students' scores were

disaggregated and compared to see if there were different outcomes. Additionally, a paired t-test was used to determine if GPA prior to the course term was significantly different than the GPA after. This limited the population to only those who had been enrolled at LMCC the previous semester and were still enrolled the semester following the course. The purpose of the t-test analysis was to indicate if there was significant change in pre and post test scores and in prior and post GPA that could be attributed to taking the learning strategies course. Next, I used multiple regression analysis to correlate students' pre and post-test scores in the categories motivation, attitude, test strategies, time management and concentration with GPA while controlling for demographic variables commonly associated with differing outcomes: race, gender, full vs part time enrollment, age and degree seeking or not. This same regression was used to correlate scores with retention and persistence the following semester. Then I examined developmental and non-developmental students separately. The purpose of the regression analysis is to determine if there is a correlation between the score and the outcome of interest. By looking at both developmental education students and non-developmental students, we can also determine if there are key differences in these outcomes due to the prior coursework requirements.

Results

First, a paired t-test was conducted with all students who had a pre and post-test score to determine if post-test scores differed significantly from pre-test scores (N=264). Scatter plots can be found in Appendix B. These scores are self-reported which indicates that students feel that

there is significant change in all five categories. All five categories are significant at $p < 0.05$.

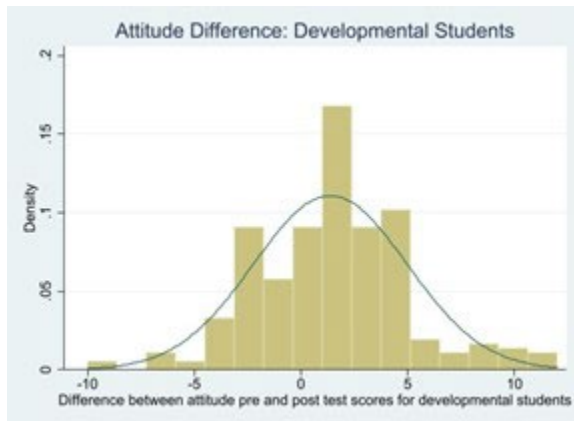


Figure 3.1. Difference between attitude pre and post-test scores

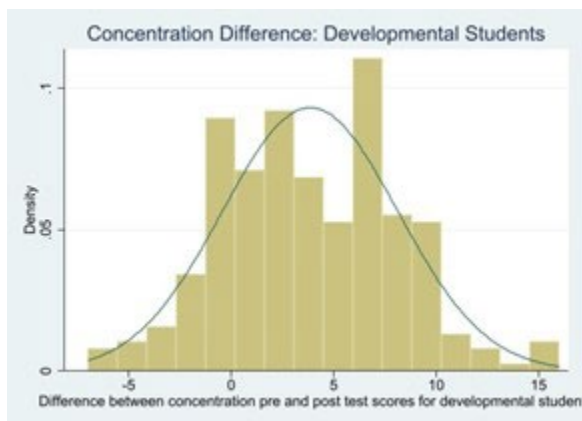


Figure 3.2. Difference between concentration pre and post-test

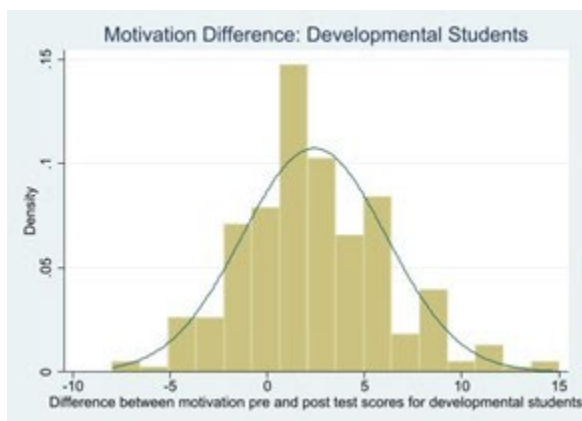


Figure 3.3. Difference between motivation pre and post-test scores

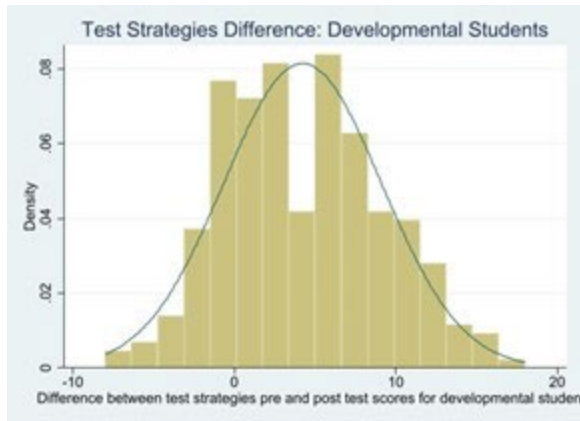


Figure 3.4. Difference between test strategies pre and post-test scores

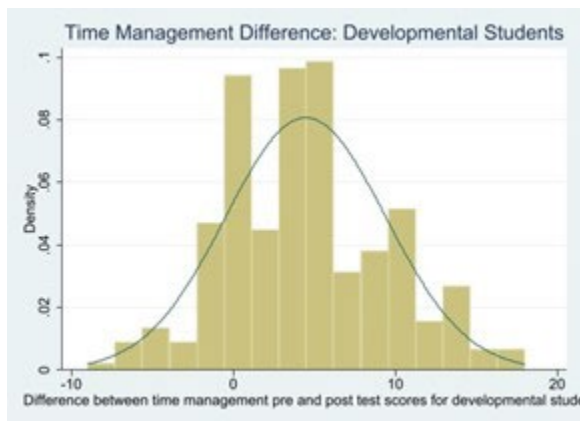


Figure 3.5. Difference between time management pre and post-test scores

To use another measure to evaluate the impact of the course, I examined GPA the semester before the course and GPA the semester after the course. Only students who were enrolled at the college the semester prior and the semester after are included (N=222). As demonstrated by Figure 14, students demonstrate a significant difference at the 95% confidence interval between GPA prior to taking the learning strategies course and the semester following with a negative coefficient of 0.08. When the developmental students who received a scholarship to take the course for free were disaggregated (N=116), the negative GPA coefficient increases to -0.13. Here scholarships serve an additional function of indicating graduation from developmental to credit bearing coursework. Those

without the scholarship, though still developmental (N=106), do not indicate a insignificant relationship between GPA prior and post semesters.

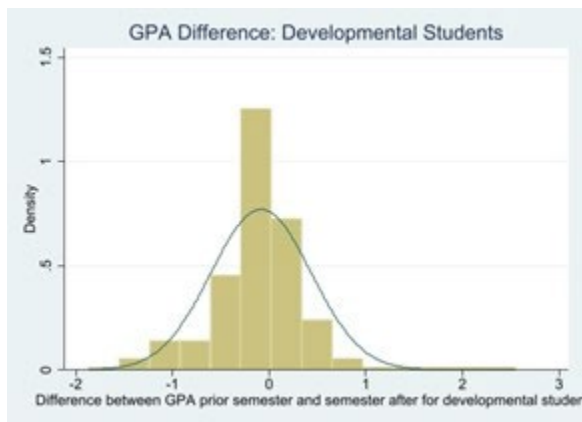


Figure 3.6. GPA Difference for All Developmental Students

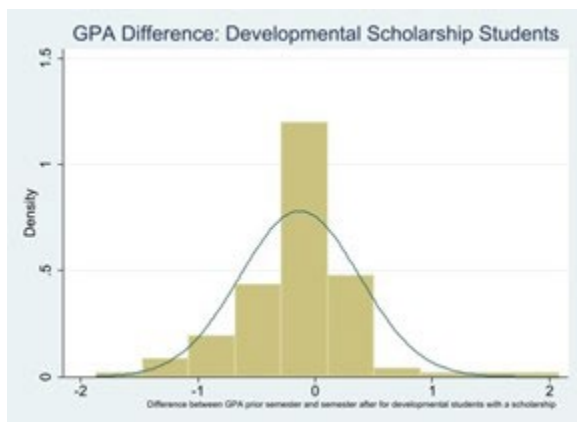


Figure 3.7. GPA for Developmental Students with a Scholarship Transitioning to Credit Bearing Coursework

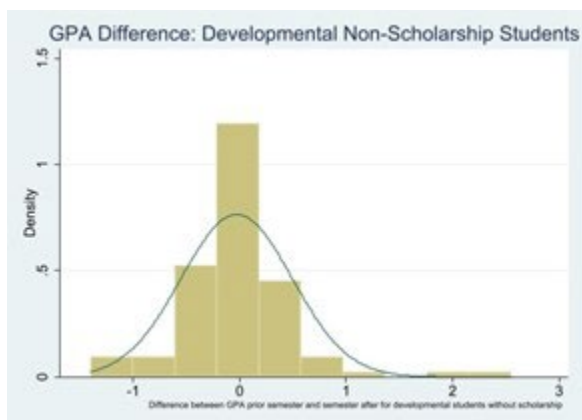


Figure 3.8. GPA Difference for Developmental Students without a Scholarship

Utilizing multiple regression analysis, GPA the semester following the course and LASSI scores

were correlated. Both pre and post test scores were compared as students who took only the pre-test likely did not finish the class or at least did not complete the post-test assignment. There were 298 students with pre-test scores and GPA the semester following, and 237 students with both pre and post-test scores and GPA the following semester. The regression equation is $Y = b_0 + b_1 + b_2 \dots b_{14} + E$ with y being gpa after and b1 being pre and post test scores for each LASSI category. B2 and following are the control variables such as female, Asian and other demographics, and b0 is the coefficient. All pre-test scores are significant, and motivation, test strategies and time management post-test scores are as well. The coefficients represented in Figure 15 show the mean increase in post GPA scores for each 1 point higher in pre and post-test scores.

GPA for Developmental Students Pre and Post-Test Correlations

	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.032** * (.011)									
Attitude Post-Test		-.007 (.013)								
Concentration Pre-Test			.036** * (.009)							
Concentration Post-Test				.013 (.01)						
Motivation Pre-Test					.053** * (.013)					
Motivation Post-Test						.051* ** (.014)				
Test Strategies Pre-Test							.041** * (.01)			

Test Strategies Post-Test								.026**		
								(.013)		
Time Management Pre-Test									.037**	
									*	
									(.009)	
Time Management Post-Test										.021**
										(.009)
_cons	1.787* **	2.376* **	1.881* **	1.985* **	1.303* **	.959* *	1.642* **	1.659* **	1.861* **	1.817* **
	(.278) 298	(.355) 237	(.25) 298	(.31) 237	(.298) 298	(.39) 237	(.28) 298	(.353) 237	(.237) 298	(.279) 237
Observations										
R-squared	.106	.119	.121	.124	.139	.17	.131	.136	.127	.134

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.2. LASSI Scores correlated with GPA for Developmental Students

Multiple regression was also run to determine if there is correlation between scores and retention using the same formula. This regression uses the same formula $Y = b_0 + b_1 + b_2 \dots b_{14} + E$ but with retention as the y variable. The sample includes 354 observations for pre-test scores and 264 for post-test scores.

Retention for All Developmental Students										
	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.
Attitude Pre-Test	.007 (.005)									
Attitude Post-Test		-.002 (.004)								
Concen. Pre-Test			-.001 (.005)							
Concen. Post-Test				.001 (.004)						
Motivation Pre-Test					.005 (.005)					

Motivation Post-Test						.009 (.006)				
Time Management Pre-Test							.004 (.004)			
Test Strategies Pre-Test								-.002 (.005)		
Test Strategies Post-Test									-.001 (.005)	
Time Management Post-Test										.002 (.004)
_cons	.727* ** (.13) 354	1.012* ** (.125) 264	.859* ** (.103) 354	.941* ** (.112) 264	.742* ** (.134) 354	.739* ** (.159) 264	.797* ** (.097) 354	.876* ** (.11) 354	.987* ** (.124) 264	.929* ** (.117) 264
Observations										
R-squared	.044	.042	.038	.041	.041	.052	.04	.038	.041	.042

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.3. Retention (whether students reenrolled at LMCC) the following semester correlated with LASSI Scores

No category of the LASSI is significantly correlated with retention. Then I examined persistence to see if these students continued in their schooling, even if it wasn't at LMCC using $Y = b_0 + b_1 + b_2 \dots b_{14} + E$ with rtg (Retain, Transfer or Graduate) as the y variable. The sample size is the same as that of retention.

Persistence for All Developmental Students										
	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist	Retain Transfer Persist
Attitude Pre-Test	.007 (.005)									
Attitude Post-Test		.002 (.004)								
Concen. Pre-Test			.004							

			(.004)							
Concen. Post-Test			.006**							
			(.003)							
Motivation Pre-Test			.007							
			(.005)							
Motivation Post-Test			.013**							
			(.005)							
Test Strategies Pre-Test			.005							
			(.003)							
Test Strategies Post-Test			.007**							
			(.003)							
Time Management Pre-Test			.004							
			(.003)							
Time Management Post-Test			.005							
			(.003)							
_cons	.75**	.983**	.823**	.901**	.737**	.681**	.789**	.864**	.825**	.927**
	*	*	*	*	*	*	*	*	*	*
	(.114)	(.108)	(.09)	(.092)	(.116)	(.139)	(.088)	(.098)	(.082)	(.096)
	354	264	354	264	354	264	354	264	354	264
Observations										
R-squared	.054	.044	.048	.056	.052	.082	.05	.057	.048	.052

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.4. Persistence (whether students reenrolled, transferred the next semester or graduated) correlated with LASSI Scores.

Concentration, motivation and test strategies post-tests are significantly correlated with persistence. Higher concentration post-test scores increase the likelihood of persistence by .6%, test strategies by .7%, and motivation post-test scores increase the likelihood by 1.3%. categories with a sample size of 148

Pandemic

Since the data collected spans pandemic years, I have disaggregated the results by pre-pandemic (N=157) and pandemic years (N=107). All LASSI pre and post-test scores t-tests indicate

significant correlation indicating change from the start to end of course.

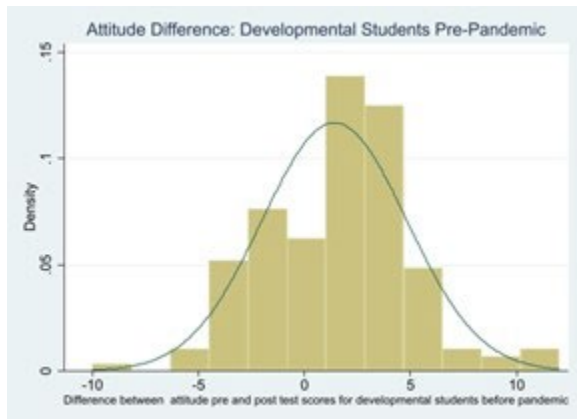


Figure 3.9. Attitude pre and post-test differences pre-pandemic

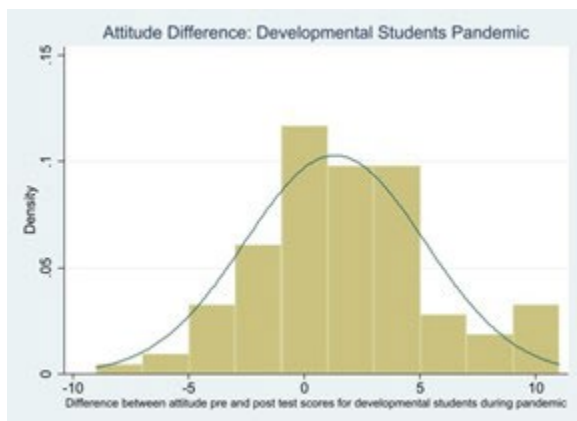


Figure 3.10. Attitude pre and post-test differences during pandemic

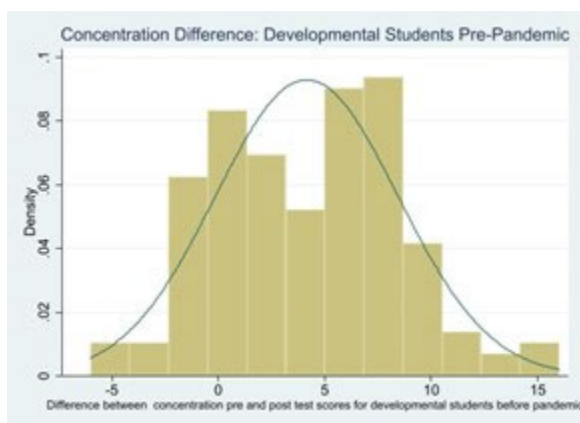


Figure 3.11. Concentration pre and post-test differences before pandemic

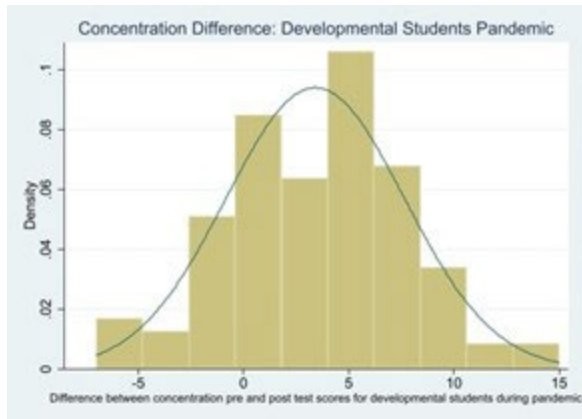


Figure 3.12. Concentration pre and post-test differences during pandemic

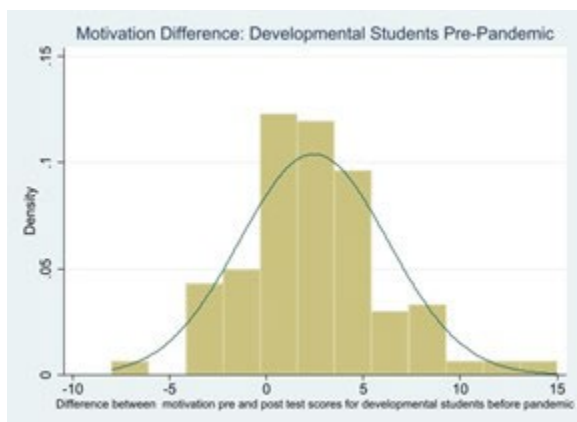


Figure 3.13. Motivation pre and post-test differences before pandemic

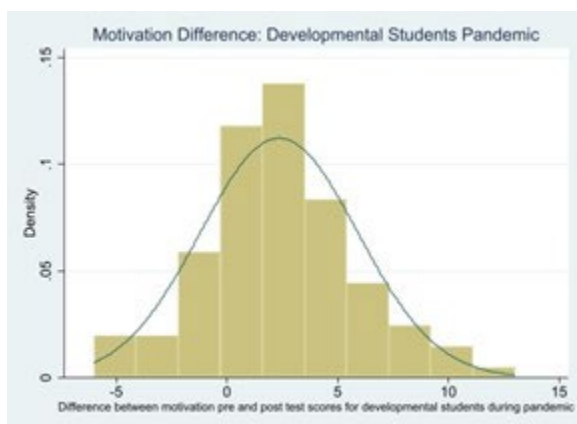


Figure 3.14. Motivation pre and post-test differences during pandemic

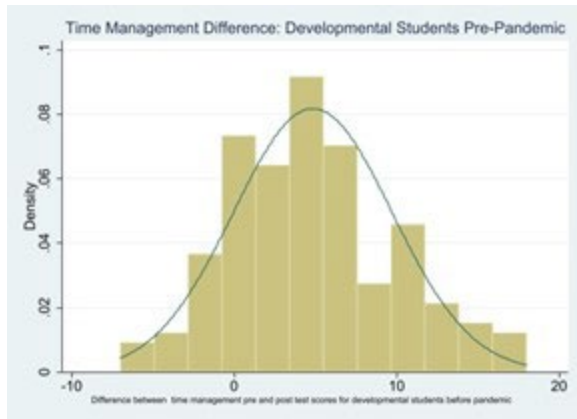


Figure 3.15. Time management pre and post-test differences before pandemic

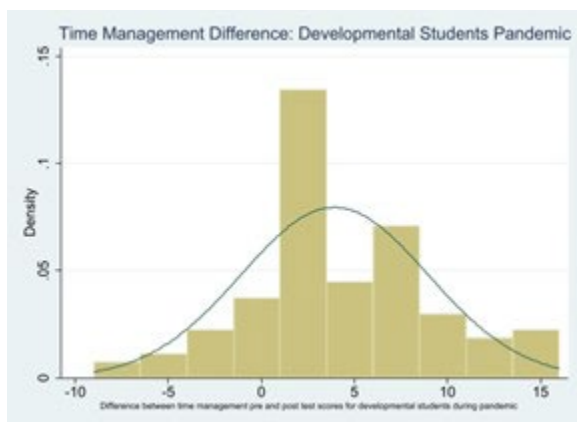


Figure 3.16. Time management pre and post-test differences during pandemic

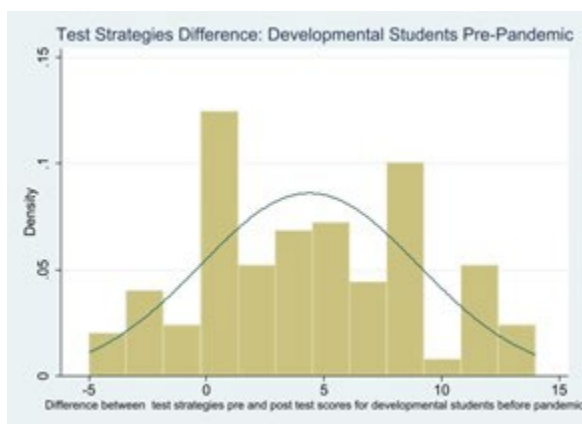


Figure 3.17. Test strategies pre and post-test differences before pandemic

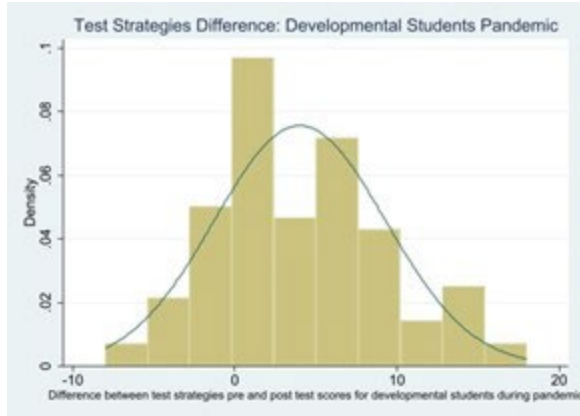


Figure 3.18. Test strategies pre and post-test differences before pandemic

Similar to previously, GPA is significant, but only before the pandemic (N=127). During the pandemic (N=95), GPA is insignificant. As before, scholarship students show a significant, negative difference in GPA before the pandemic (N=62), but for scholarship students, this too disappears during the pandemic (N=54). Non-scholarship students consistently indicate no significant relationship between GPA prior and post semesters either before (N=65) or during the pandemic (N=41). As a note, the sample size for each is relatively small, which can skew the results.

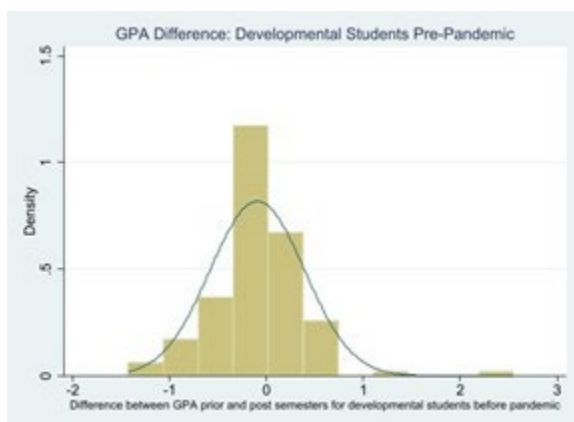


Figure 3.19. GPA difference between semester prior and semester after the course for pre-pandemic

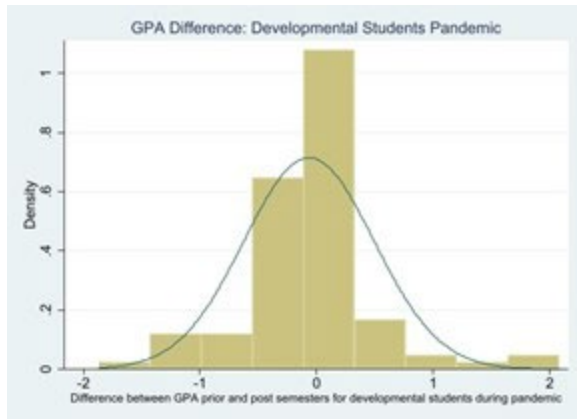


Figure 3.20. GPA difference between semester prior and semester after the course for during the pandemic

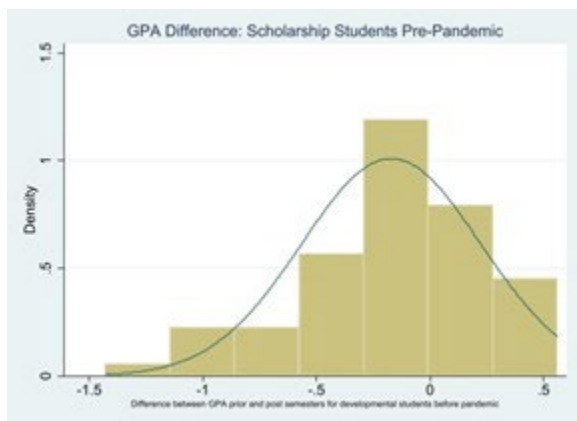


Figure 3.21. GPA difference between semester prior and semester after the course for pre-pandemic for scholarship students

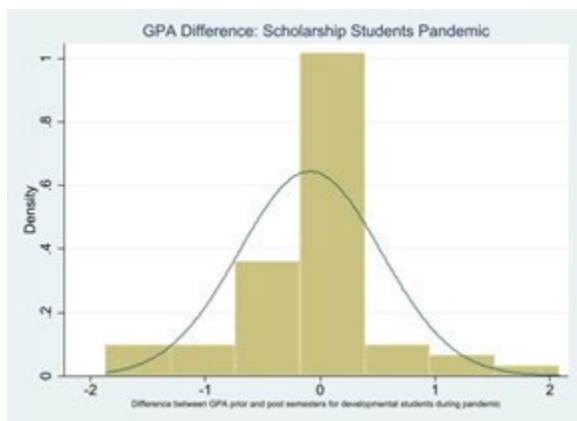


Figure 3.22. GPA difference between semester prior and semester after the course during the pandemic for scholarship students

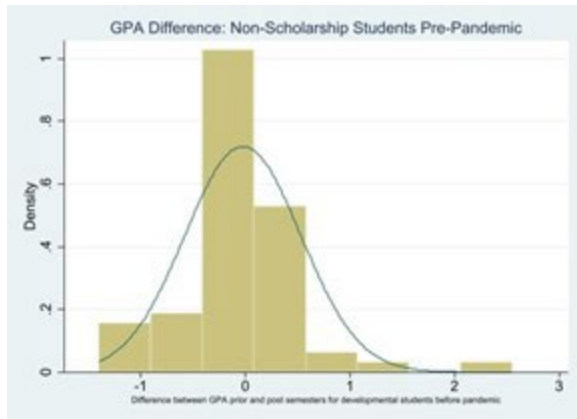


Figure 3.23. GPA difference between semester prior and semester after the course for pre-pandemic for non-scholarship students

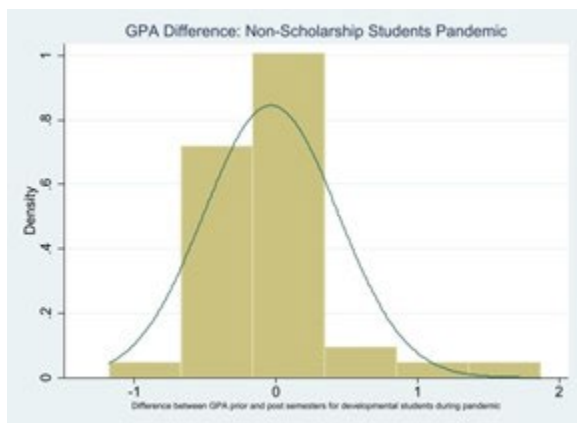


Figure 3.24. GPA difference between semester prior and semester after the course during the pandemic for non-scholarship students

LASSI scores shift in what does and does not remain significant. Concentration, motivation, test strategies and time management pre-tests and motivation post-tests remain correlated with GPA both before and during the pandemic. Attitude pre-test scores, test strategies post-test scores and time management post test scores are not significant during the pandemic.

GPA for Developmental Students Pre and Post-Test Correlations Before Pandemic

	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.031* * (.013)									
Attitude Post-Test		.007								

Concen. Pre-Test		(.016)		.032**							
Concen. Post-Test			(.013)	.007							
Motivation Pre-Test				(.015)	.037**						
Motivation Post-Test					(.018)	.044* **					
Test Strategies Pre-Test						(.016)	.037** *				
Test Strategies Post-Test							(.013)	.055* **			
Time Management Pre-Test								(.019)	.028**		
Time Management Post-Test									(.011)	.022*	
_cons	1.84* ** (.356) 170	2.368* ** (.462) 139	1.951* ** (.336) 170	2.384* ** (.445) 139	1.641* ** (.417) 170	1.425 ** (.545) 139	1.687* ** (.406) 170	1.292 ** (.559) 139	2.038* ** (.321) 170	2.099* ** (.4) 139	(.012)
Observations											
R-squared	.147	.135	.153	.135	.153	.173	.16	.205	.151	.155	

Robust standard errors are in parentheses
*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.5. GPA and LASSI for Developmental Students Before Pandemic

GPA for Developmental Students Pre and Post-Test Correlations During Pandemic

	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.032* (.018)									
Attitude Post-Test		-.014 (.023)								

Concen. Pre-Test										
Concen. Post-Test										
Motivation Pre-Test										
Motivation Post-Test										
Test Strategies Pre-Test										
Test Strategies Post-Test										
Time Management Pre-Test										
Time Management Post-Test										
_cons	1.701* ** (.449) 128	2.078* ** (.578) 98	1.794* ** (.37) 128	1.361* ** (.459) 98	.893* * (.447) 128	.066 (.582) 98	1.514* ** (.385) 128	1.706* ** (.526) 98	1.7** * (.324) 128	1.272* ** (.434) 98
Observations										
R-squared	.183	.272	.205	.287	.247	.35	.225	.269	.207	.288
<i>Robust standard errors are in parentheses</i>										
<i>*** p<.01, ** p<.05, * p<.1</i>										

Table 3.6. LASSI scores and GPA for Developmental Students During Pandemic
Retention scores remain the same before and during the pandemic; no category is correlated with retention specifically.

Retention for Developmental Students Before the Pandemic										
	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.
Attitude Pre-Test	.009 (.007)									
Attitude Post-Test		-.004								

Concentration Pre-Test		(.006)								
Concentration Post-Test										
Motivation Pre-Test										
Motivation Post-Test										
Time Management Pre-Test										
Time Management Post-Test										
Test Strategies Pre-Test										
Test Strategies Post-Test										
_cons	.647** * (.185) 201	.98*** (.193) 157	.918** * (.15) 201	.898** * (.195) 157	.718** * (.196) 201	.685** * (.245) 157	.788** * (.141) 201	.889** * (.17) 157	.941** * (.177) 201	.969** * (.222) 157
Observations										
R-squared	.052	.056	.053	.054	.044	.061	.042	.054	.05	.056

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.7. Retention for Developmental Students Before the Pandemic

Retention for Developmental Students During the Pandemic										
	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.	Retain Next Sem.
Attitude Pre-Test	.003									
	(.008)									
Attitude Post-Test		-.004								
		(.006)								
Concentration Pre-Test			.006							

				(.007)						
				.002						
Concentration Post-Test					(.006)					
Motivation Pre-Test					.007					
Motivation Post-Test					(.008)					
					.011					
Time Management Pre-Test					(.009)					
					.007					
Time Management Post-Test					(.007)					
					.005					
Test Strategies Pre-Test					(.006)					
					.005					
Test Strategies Post-Test					(.006)					
					.001					
_cons					(.005)					
	.811**	.98***	.798**	1.005*	.725**	.775**	.768**	.949**	.787**	1.014*
	*		*	**	*	*	*	*	*	**
	(.185)	(.193)	(.134)	(.132)	(.188)	(.229)	(.136)	(.182)	(.137)	(.14)
	153	157	153	107	153	107	153	107	153	107
Observations										
R-squared	.098	.056	.103	.089	.102	.106	.105	.094	.101	.088

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.8. Retention for Developmental Students During the Pandemic

Persistence also shifts but even more dramatically when disaggregating before and during the pandemic. Before disaggregating, concentration, motivation and test strategies post-test scores are significant, but when examining the pre-pandemic years, no category at all is significant. However, during the pandemic, concentration pre-test scores, motivation pre and post-test scores, test strategies and time management pre-test scores are all significant.

Persistence for Developmental Students Before the Pandemic										
Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain
Transfer	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer
Graduate	Graduate	Graduate	Graduate	Graduate	Graduate	Graduate	Graduate	Graduate	Graduate	Graduate

Attitude Pre-Test	.004 (.006)									
Attitude Post-Test		0 (.005)								
Concentrati on Pre-Test			-.005 (.005)							
Concentrati on Post-Test				.005 (.004)						
Motivation Pre-Test					.001 (.006)					
Motivation Post-Test						.011 (.007)				
Test Strategies Pre-Test							-.001 (.005)			
Test Strategies Post-Test								.009 (.006)		
Time Managemen t Pre-Test									-.002 (.004)	
Time Managemen t Post-Test										.003 (.004)
_cons	.787** * (.154) 201	.915** * (.153) 157	.92*** (.12) 201	.825** * (.15) 157	.838** * (.156) 201	.619** * (.204) 157	.877** * (.124) 201	.712** * (.163) 157	.885** * (.107) 201	.852** * (.126) 157
Observation s										
R-squared	.038	.063	.041	.07	.035	.091	.035	.082	.036	.068

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.9. Persistence for Developmental Students Before the Pandemic

Persistence for Developmental Students During the Pandemic										
	Retain Transf er Gradua te	Retain Transfer Graduat e	Retain Transf er Gradua te	Retain Transfe r Gradua te	Retain Transfe r Gradua te	Retain Transfe r Gradua te	Retain Transfe r Gradua te	Retain Transfer Graduat e	Retain Transfe r Gradua te	Retain Transfe r Gradua te
Attitude Pre-Test	.011*									

Attitude Post-Test	(.007)	.004								
Concentration Pre-Test		(.006)	.014*							
Concentration Post-Test			(.006)	.008*						
Motivation Pre-Test				(.004)	.016**					
Motivation Post-Test					(.007)	.016**				
Test Strategies Pre-Test						(.008)	.013**			
Test Strategies Post-Test							(.005)	.005		
Time Management Pre-Test								(.004)	.014**	
Time Management Post-Test									(.006)	.008
_cons	.732*	1.038*	.751*	.975**	.612**	.723**	.714**	1.018*	.735**	(.005)
	**	**	**	*	*	*	*	**	*	*
	(.166)	(.187)	(.126)	(.121)	(.175)	(.216)	(.123)	(.132)	(.125)	(.17)
	153	107	153	107	153	107	153	107	153	107
Observations										
R-squared	.118	.11	.144	.131	.131	.16	.132	.114	.135	.127

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 3.10. Persistence for Developmental Students During the Pandemic

Discussion

The t-test of pre and post-test scores in all LASSI categories demonstrate a consistent, significant relationship. The p-value for all categories and all populations is $p < .001$. This indicates that students believe that they have improved in all five areas from pre to post-test over the course of the six-week learning strategies course. The assumption is that the skills they learned in the course increased their believed ability in these areas. However, we know that these beliefs and attitudes are not always accurately assessed by students as a result of the Dunning-Krueger effect. We also know that having the skills and knowledge that something should be done does not always mean that it happens, and actually putting knowledge into practice is the key element impacting performance (Clear, 2018). As such, it is also important to note whether these beliefs correlate with outcomes. Using a two-sample t-test once again, GPA the prior semester and the semester after taking the course are significantly, negatively correlated, indicating that there was a negative change from the previous semester to the semester following the course. This remains for the students who received the scholarship to take the course, indicating a significant, negative correlation of -0.13 GPA points. However, this is not significant for non-scholarship developmental students, and is not significant for students who took the scholarship during the pandemic. The scholarship is offered to students who are graduating from developmental coursework to credit bearing coursework for the semester of transition. Therefore, the scholarship variable serves as a latent variable to allow me to separate out students engaged in credit bearing coursework as opposed to those still in their developmental sequence. This is relevant because the transition from developmental to credit-bearing courses is often one marked by struggle with successful transition rates at 22% according to one study (Xu & Ran, 2020).

To examine this further, if I run a t-test for GPA prior and GPA during, the significance remains, but not if I run a t-test for GPA during and GPA after. This indicates that the struggle is concentrically located in the semester they moved to credit bearing coursework and took the scholarship. It is also possible that there is a lack of buy-in for students who receive the scholarship as the course is free, and as such, their grade is lower, impacting their overall GPA. There is some evidence for this. Figure 26 compares the mean grade of developmental students with and without the scholarship. When conducting a two-sample t-test, the mean grade for those without a scholarship is 3.01 (or a B) and for scholarship students is 2.65 (or a C+) with a p-value of .03. Those who did not receive the scholarship, though developmental students, either took the course before eligibility or after. Those who took the course beforehand were possibly motivated to take the course for its own merit without the financial incentive, and as the next section indicates, motivation is correlated with GPA.



Figure 3.25. The mean grade in the learning strategies course (4=A and 0=F) disaggregated by scholarship recipients.

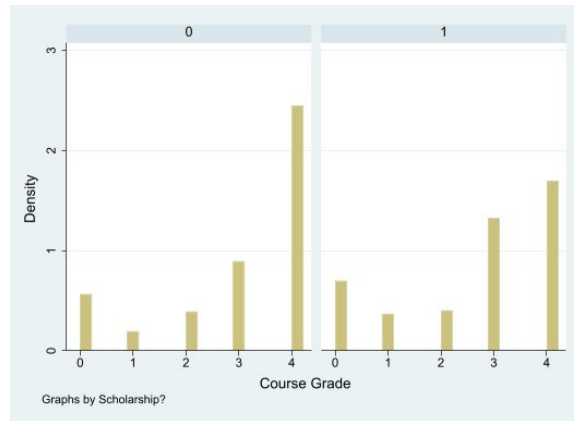


Figure 3.26. Another view of mean grade in the learning strategies course (4=A and 0=F) disaggregated by scholarship recipients.

Besides looking at the difference between GPA before and after the learning strategies course, I also regressed the GPA after with the five LASSI categories for the total population. The purpose was to isolate the impact of each category on GPA to determine if the two are correlated. I included both the pre and post-test to give us some insight from those students who did not complete the second assessment and because the scores students have at the start of the semester (or course) could differ from those scores later, especially as they are measuring psychological elements. For developmental students, all pre-test scores and motivation and test strategies post-test scores are significantly correlated (at $p < .05$) with GPA the following term. Motivation and test strategies seem particularly impactful as they are correlated at both points in the course.

Retention and LASSI scores are not correlated for developmental students. Persistence scores allow for a slightly larger scope as to score a 1 on persistence, students either remain enrolled or transfer that next semester or graduate. This allows me to see if students are committed to finishing their education rather than committed to finishing it at LMCC.

Developmental students indicate a correlation between concentration, motivation, and test strategies post-test scores. Concentration and test strategies are considered to be self-regulation skills, so the connection with persistence is unsurprising as it takes a similar degree of self-

regulation to make re-enrollment decisions. This also reflects the findings of Robbins and colleagues (2009). The link to motivation and persistence would be consistent with that of several researchers (Fong et al., 2016; Robbins et al., 2006; Pintrich & Meece, 2008). Research from Prus et al. (1995) linked first year retention and LASSI concentration scores. Test strategies are usually correlated with academic outcomes, which is consistent with my findings earlier, and academic outcomes can predict future decisions such as retention and persistence (Fong et al., 2016; Martin, 2014; Pascarella and Terenzini, 2005). However, while those factors influence their decision to continue pursuing education, it does not indicate a particular commitment to LMCC.

The Covid-19 pandemic is also a factor in this data. There are still significant changes via two sample t-test in pre to post test scores for all LASSI categories before and during the pandemic. GPA prior and post is still significant overall pre-pandemic, but during the pandemic there is not significant correlation between GPA before and after the course. In the overall data, it is clear that there is a correlation between course enrollment, scholarship receipt and lower GPA. However, when separating this before and during the pandemic, it is only before the pandemic that this still occurs. As I mentioned previously, scholarship receipt is a latent variable for the semester students transfer to the credit bearing coursework. It is therefore interesting that this negative correlation disappeared during the pandemic. It is possible that students took less rigorous schedules during the pandemic or had more time for schoolwork as work obligations changed or shrunk. It would be useful if we could isolate the cause for this change, though I will also note that the sample size was reduced to 63 pre-pandemic and 54 during the pandemic so these results should be interpreted with caution.

The LASSI scores that correlate with GPA do change when disaggregating pre and pandemic years. Before disaggregating, all pre-test scores and motivation and time management post-test scores are correlated with GPA. Before the pandemic, those same categories remain significant but also include test strategies post-test scores. Test strategies were only significant for the overall sample at $p < 0.1$ (instead of the requisite .05) so they gain slightly in the disaggregation, but they are not significant during the pandemic. Additionally, time management loses significance during the pandemic as does attitude.

This indicates that during the pandemic, having the right attitude was not enough to impact students' GPA. LASSI attitude questions relate to whether students feel control over their coursework, if they are interested in and value what they are learning, if they are more job or academic focused, and if they are undecided (Weinstein et al., 2016). Therefore, it makes sense that the pandemic might impact attitude scores. Test strategies is similarly only significantly correlated with GPA before the pandemic. It is possible that the strategies that are taught in the learning strategies course were effective before the pandemic brought about changes in the way students were tested. Often the way that students took exams during the pandemic varied greatly and some of the strategies that students learn in the course might no longer have worked effectively. In fact, there has been discussions in the department about discussing online and in-person test strategies separately since some of the methods, like skipping questions to return to later, are impossible in some online mitigated tests.

Retention was insignificant for the overall data and this remains the case when examining pre-pandemic and pandemic years. Persistence outcomes in light of disaggregation by pre-pandemic and pandemic years is also illuminating. Just like retention, not one category of the LASSI is correlated with persistence in the pre-pandemic years. However, during the pandemic,

developmental students do have a significant relationship between persistence and concentration post-test, motivation pre and post-test, test strategies pre-test and time management pre-test scores. In the midst of economic and social upheaval, developmental students may in fact have to draw on their motivation to persist. Additionally, concentration, test strategies and time management may take on new significance during this era of uncertainty.

Many of the questions about concentration relate to whether students can remain focused, whether their mind wanders and whether they are restless and moody (Chacko & Huba, 1991). If developmental students are more likely to have full time jobs, and family concerns due to their slightly older age (which is statistically higher for developmental students in this sample) (Vancell, 2018; Xu & Ran, 2020), then it is possible that concentration is particularly important for these students. Time management pre-test scores could be relevant for similar reasons as time management is more important for non-traditional students, and developmental students in my sample are statistically older and more likely to utilize Pell Grants than non-developmental students (see Appendix B). Fong et al. (2021) theorized that test strategies may actually be useful as a tool to mitigate anxiety as much as for the strategies themselves. If so, this sense of having a strategy to utilize when one feels stuck might make students less anxious thereby increasing their sense of self-efficacy and impacting their persistence decisions.

Overall, it is the motivation post-test scores that are the most consistent throughout. When disaggregating for pre-pandemic and pandemic years, students show motivation post-test scores relate to GPA, retention and persistence for pandemic years and it remains significantly correlated with GPA in pre-pandemic years as well. Motivation pre-test scores are also significantly correlated with GPA and persistence, indicating that even for students who did not complete a post-test, motivation is an important factor in their academic outcomes. This is

consistent with literature comparing intrinsic and extrinsic motivation and academic outcomes (Areepattamannil et al., 2011; Ayub, 2010; Trevino & DeFreitas, 2014), and with analyses of LASSI's reliability which frequently consider motivation as reliable and related to academic outcomes (Chacko & Huba, 1991; Fong et al., 2021; Kahlil et al., 2019; Zhou et al, 2016). Since developmental students are at a higher risk of dropping out (Burley et al., 2001), it may be these psychological characteristics that make the difference. If these scores are statistically higher, as the t-tests show, at the post-test and therefore, end of the learning strategies course, then courses like this should be highly encouraged for developmental students. Additionally, since these factors have significant correlations with GPA and persistence, especially after the pandemic began, then it is important to spend adequate course time on material that could increase these psychological factors.

Limitations and Further Research

The research herein is derived from a single institution and as such, could have limited generalizability due to the way this learning strategies course is implemented as well as unforeseen factors present at this institution that are not elsewhere. This is correlational data as well, not causal. It is also based on an assessment that is self-reported which can mean that some beliefs about one's performance are inaccurate (as Dunning-Krueger theorizes) and that these beliefs may not clearly transfer to behavior and outcomes, which is why three types of regression outcomes in addition to t-tests were utilized so as to help triangulate the difference.

Since developmental students are already a vulnerable population, if the beliefs evidenced in the LASSI can make a difference in their academic and persistence outcomes, it is essential that we continue to study what could make an impact on increasing these beliefs and skills. If learning strategies courses are making an impact, not only should they be required for

students in the developmental sequence, but they should be encouraged for all students as the GPA differences, though slight, are still meaningful. Additionally, we should review the course material so that we are making sure to explicitly instruct students in arenas like grit, growth mindset and attributions so that they are aware of and able to adapt their own motivation.

Chapter 4 - Chapter 4 - Online vs Face to Face: Persistence, Graduation Rates and GPA for Developmental Education Students

Literature Review

The Current Climate

Though online learning has developed strong foundations over the past two decades, the average student and teacher were not prepared to make the switch to online learning that Covid-19 made necessary. K-12 schools were subject to a national experiment in how to take a platform that has, for the most part, not existed online, to one that is either supplemented by online material, is hybrid in delivery mode or is entirely online. Colleges, though much more prepared for this transition, still had to force instructors who were untrained into an online environment they were unprepared to manage. Distance education course enrollment increased by a dramatic 93% by the end of 2020 as compared to the fall 2019, and overall enrollment dropped as well, particularly at community colleges (Lederman, 2021). 59% of colleges included in Lederman's report also indicate that they plan to sustain their distance education offerings post-pandemic (Lederman, 2021). However, Means and Neisler (2020) found in a national survey of college students that students' satisfaction sharply declined from 51% before the course went online to 19% after. Of course, courses in the spring of 2020 were not intending to shift, which can complicate these metrics. Students cited motivation as the primary issue with the shift, with 79% of students indicating this was a problem (Means & Neisler, 2020). Other issues they cited were loss of the presence of the instructor and peers, hands on learning experiences and discussion. However, students did feel the expectations were still clear, they knew where to get help and they felt their instructors knew them (Means & Neisler, 2020). In a government sponsored survey, Muhkar and colleagues determined that the advantages of e-learning were in the

flexibility, accessibility and student-centered learning environment, specifically self-directed and asynchronous learning (Muhkar et al., 2020). In addition to the disadvantages noted by Means and Neilser (2020), lack of feedback from students, attention span, and cheating were also cited as issues in Muhkar (2020). The pandemic allowed researchers the unprecedented ability to evaluate the impacts of online education without selection bias as many students who would not have ordinarily chosen to study online became online students. As such, the future of online education will be shaped by the lessons that we learn from these years.

Online Education Effectiveness

Though the consensus is that online education is effective when controlling for other factors, those other factors are particularly important to consider for developmental education students. Since the topic has far reaching impacts, there have been a number of large-scale analyses conducted to determine whether online education offers similar outcomes to face to face instruction. For the most part, these conclude that online education is as effective or even more effective than face to face education (Bowen et al., 2014; Cavanaugh & Jacquemin, 2015; Hachey, 2020; Means et al., 2010; Means et al., 2013; Schchar & Neumann, 2010). It would seem this is the end of the discussion, but many other studies have found that other characteristics such as course design, demographic and academic preparedness play a role and that online education may not be equally useful for all.

Asynchronous and Synchronous Online Education

In today's educational climate, the delivery format of instruction is a factor in student success, retention, persistence, and graduation. Therefore, it is relevant to examine general differences between asynchronous online, synchronous online and face to face (F2F) education. Ebner and Gegenfurtner (2019) conducted a meta-analysis comparing face to face, asynchronous

and synchronous (using webinars) delivery methods. They found that synchronous webinars were slightly more effective though statistically insignificant, and overall determined that all three modalities were essentially effective, though preference was given to synchronous and face to face formats. They also found that student satisfaction was highest in face to face instruction, but that this too was not statistically significant and determined that all three methods are viable with preference being given to face to face format if the option is available. This is also consistent with the U.S. Department of Education meta-analysis that found that outcomes for asynchronous, face to face and synchronous courses were essentially the same, this time with a slight preference given to synchronous online or hybrid courses (Means et al., 2010). In fact, most of the data indicates that online learning and face to face learning can have similar outcomes when controlling for mediating variables (Cavanaugh & Jacquemin, 2015; Carol and Burke, 2010; Nguyen, 2015; Somenarain et al., 2010).

On the other hand, Xu and Jaggars (2011) found that comparing the outcomes of online and face to face modalities for introductory math and English indicated a negative correlation for the online modality. In follow up research, Xu and Jaggars (2012) also observed persistence and achievement were negative in the online format as well. Their research is specifically targeted at community college students which makes their work particularly relevant. They also note that “time management and independent learning skills” might be “critical to success,” further indicating the usefulness of college success courses (Xu & Jaggars, 2012, p. 55). With the majority of research pointing to no major impact or harm from online coursework, it is practical to continue to provide online courses in order to meet the needs of particular students, but it is also important to stay alert for possible negative outcomes as well.

Online Education and Developmental Learners

If online education *can* be effective, then the question becomes *who* does this methodology have a propensity to fail. In the community college setting, the research of Xu and Jaggars show that when controlling for prior academic ability, student achievement is decreased in the online setting (Jaggars & Xu, 2010.) Follow up research remarks that young, Black, male students who were not academically proficient previously are specifically less successful in online environments (Xu & Jaggars, 2013). As Xu and Jaggars (2013) mention, some community college students lack the “soft skills” necessary to achieve in online courses. These skills include time management and study skills, both of which are at an even higher premium in asynchronous courses. Though research on developmental learners specifically is virtually non-existent (Rutschow & Schneider, 2012), Petrides and Nodine (2005) remark that student readiness, face to face interactions, access and diverse student needs are all factors that should be evaluated before recommending online coursework to developmental learners. Like Xu and Jaggars, they note that soft skills such as time management, literacy and independent learning are all necessary to online learning and are not skills which developmental learners typically have mastered. This emphasis on soft skills is similar to other research that emphasizes self-regulation, self-efficacy, motivation and self-empowerment (Jantz, 2010; Martin et al., 2014; Wadsworth et al., 2007) Wadsworth et al. (2007) also found that concentration, information processing and self-test skills impacted final grade outcomes. Research by Weems (2002) and Carpenter et al. (2004) find that academic results are somewhat similar in developmental online courses, but that dropout rates are higher online. Weems (2002), who did not measure retention, eliminated any students who did not complete from the sample, resulting in similar achievement rates but only for those who finished.

Petride and Nodine's remark that the diversity of the populations served can be a barrier is echoed in Castillo's (2013) work as well where he remarks that the needs of adult nontraditional students have differing needs than those of the younger, more academically at-risk though both end up in developmental education. For older students, the flexibility of online education may be essential. However, Castillo generally believes that there is a larger risk in offering this type of course online, citing a partnership between San Jose State University and an online education provider that offered introductory level classes and was ultimately called a failed experiment due to low pass rates (2013). Though this research is not centered on developmental education *courses*, since the population this study focuses on are developmental education students, it is relevant to note that online and face to face courses could have different outcomes. Therefore, data for each group will be separated to disaggregate those factors.

Online Classrooms: Best Practices

There is a breadth of information about best practices in the online classroom ranging from course design to technology implementation; One of the agreed upon best practices is that course design must be deliberate (Maddix et al, 2012, Fish & Wickersham, 2009). Often teachers simply upload PowerPoints or handouts from their in-person classes which is ineffective. Research shows that students find online videos as the preferred method of distance education if traditional courses are not possible (Downing, 2020). Another best practice is faculty support and collaboration (Fish & Wickersham, 2009). Given the amount of work and expertise that is required in building effective online courses, faculty collaboration could go a long way in curating meaningful content. Providing student support in terms of technology use, time management and study strategies is cited as another best practice (Fish & Wickersham, 2009). Students with greater academic preparation historically do better than those with subpar

preparation (Jaggars & Xu, 2010). Therefore, many recommend leveling the playing field by providing this type of academic support and preparation for students. One of the ways to do this is in providing college success courses that help students adjust to college academic expectations, college life and college study strategies (Linder et al., 2018). Another form of providing student support is creating social presence and facilitating in the online environment (Fish & Wickersham, 2009; Downing, 2020; Maddix et al, 2012). Social presence is a student's sense that a professor is real, tangible and available to them. Finally, reflection and analysis of the effectiveness of the course and its outcomes are essential. Self-evaluation is crucial for growth and improvement and, as such, is a best practice in online education too. Therefore, since there can be a wide array of methods in online instruction, it can be difficult to classify outcomes when the modality can fluctuate so widely.

Social Presence in the Online Classroom

As mentioned above, a key issue of online learning is the social presence of the instructor. Though this is defined in a variety of ways, most definitions include students' perceptions of the instructor as "real" and assessable. A meta-analysis of studies on social presence indicates positive correlations between social presence and satisfaction and social presence and perceived learning (Richardson et al, 2017). This is consistent with other findings (Gunawardena and Zittle, 2009; Berge, 2008). In a study of Chinese university students during the Covid-19 pandemic, the authors found that interaction and course satisfaction and academic self-efficacy were related (She et al., 2021). Additionally, self-efficacy was related to engagement and that engagement correlated with satisfaction. However, there is not clear evidence that this increases student achievement as studies indicate no growth in some

assessments, growth in others and growth that is attributed to social presence from peers rather than from instructors (Hostetter and Busch, 2006; Richardson et al, 2017).

Summation

There is very little research on college success courses and course modality, and what there is does not measure academic outcomes (Abts, 2012). This is problematic since the research on online education is mixed. Most meta-analyses note that online education has essentially equitable impacts especially when controlling for other variables. However, the research on developmental learners and online modalities is sparse and the little there is reports negative impacts. Though we know that quality of instruction and sense of belonging are important for some outcomes, there is also a wide variance in how online courses are developed and the social presence of the instructor varies. Therefore, delineating academic outcomes by modality would be a step towards mitigating the dearth of information there is regarding developmental education students and online education.

Methodology

Participants

Participants are students who have taken the learning strategies course from 2018-spring 2022 either online or asynchronously online. Students who completed the course before the college shut down in the spring of 2020 were also included, but those who took the course after the shut down in the spring of 2020 were removed from the sample (N=10). These students were split about 50/50 in what modality they intended to utilize, but were all required to take the course online. There were 354 students overall: 200 taking the course face to face and 154 taking the course online or hybrid. Before the pandemic, 59 students took the course online and 142 face to face. During the pandemic, 95 students took the course online and 58 face to face. As such, I felt they did not indicate a true representation of the sample. I will collect race, gender, age, Pell grant status, full/part time and degree seeking demographics in addition to whether or not the student is currently enrolled in developmental education, previously enrolled or never enrolled. Outcomes for students from 2018-2019 will be collected and compared by course modality as well as outcomes from 2020-2022. Outcomes to be collected are grade in the course, GPA during and following semester, retention and persistence. The course was offered both online and in person even during the pandemic.

Summary Statistics: Modality

	<i>N</i>	Mean	Standard Deviation	min	max
Face to Face	354	.5649718	.4964624	0	1
Modality					
Scholarship	354	.3757062	.4849902	0	1
Recipient					
Degree Seeking	354	.8954802	.3063667	0	1
Received Pell	354	.3502825	.4777336	0	1
Grant					

Term Full Time Status	354	.579096	.494403	0	1
Black	354	.0960452	.2950703	0	1
American Native	354	.0028249	.0531494	0	1
Asian	354	.039548	.1951706	0	1
White	354	.4858757	.5005079	0	1
Hispanic	354	.1610169	.3680668	0	1
Pacific	354	.0056497	.0750581	0	1
International	354	.0762712	.2658072	0	1
Not Reported	354	.0451977	.2080316	0	1
Two or More Races	354	.0875706	.2830695	0	1
Female	354	.6666667	.5067998	0	3
Grade	328	2.865854	1.422942	0	4
GPA Prior Sem.	273	2.846117	.8638365	0	4
GPA Following Sem.	298	2.829564	.8456819	0	4
Retain	354	.8418079	.3654375	0	1
Retain/Transfer/Graduate	354	.8813559	.3238269	0	1

Note: All binary variables express their mean in terms of percentage. For GPA and Grade, the mean indicates the GPA on a 4 point scale or the grade with 4 indicating an A, 3 a B and so on.

Table 4.1. Summary statistics for the sample.

Procedure

Multiple regression analysis for 2018-2019 was performed on grades, GPA during and after, retention and persistence disaggregating by course modality. I ran separate analysis on 2020 to spring 2022 semesters. As noted above, I eliminated 10 students who took the learning strategies course from March 2020-May 2020 as they were unable to choose their modality. I included race, gender, age, Pell grant status, full/part time and degree seeking as control variables and disaggregated results by developmental and non-developmental students.

Results

I ran four multiple regression analyses with y being grades, GPA, retention and persistence and b1 whether the student was face to face in their learning strategies course. The regression equation is $Y=b_0+b_1+b_2\dots b_{14}+E$. The intention is to determine if face to face instruction is correlated with differing outcomes, however I only know if the student was face to face in this course (not if they are entirely online), so I can only draw correlations between modality for the learning strategies course and outcomes.

Grade in Course and Modality: Overall			
	Overall Grade	Pre-Pandemic Grade	Pandemic Grade
Face to Face Modality	.683*** (.164)	.85*** (.234)	.519* (.266)
_cons	1.83*** (.376)	2.236*** (.458)	1.208** (.6)
Observations	328	188	140
R-squared	.118	.144	.141

Robust standard errors are in parentheses
 *** $p < .01$, ** $p < .05$, * $p < .1$

Table 4.2. Using a four-point scale (4=A and 0=F), results indicate the impact of being face to face versus online and hybrid on course grade.

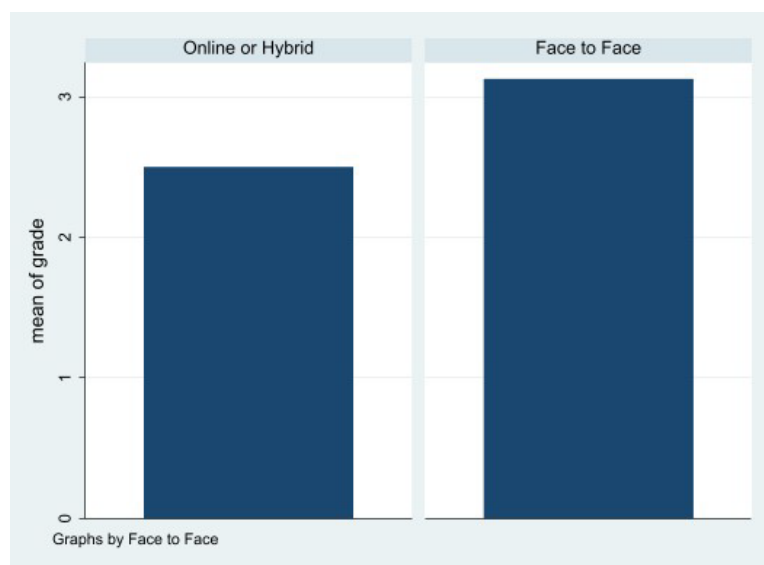


Figure 4.1. Bar graph comparison of grade by modality overall

Students' grade in the course is significantly higher at $p < .05$ and over a half letter grade higher if they are face to face versus online or hybrid modalities. This is true prior to the pandemic but becomes slightly insignificant at just over $p < 0.053$ for the pandemic years.

Another outcome I examined was GPA. The regression equation is $Y = b_0 + b_1 + b_2 \dots b_{14} + E$ but with GPA the semester during the course and the semester after the course as Y . The purpose of examining GPA was to extrapolate these results to see if the learning strategies were learned more effectively face to face rather than online or hybrid and as determined by differing impacts on GPA overall. The limitation for the GPA during is that the learning strategies course is taken at varying points in the semester, therefore potentially limiting its application. Therefore, I also include GPA after for those students who re-enrolled. This provides a larger scope but also gives an idea of the longevity of the strategies' impacts. It is, however, limited to those who reenrolled, so both are included.

GPA during the Semester and Modality: Overall			
	Overall GPA during	Pre-Pandemic GPA during	Pandemic GPA during
Face to Face Modality	.11 (.102)	.244* (.146)	.132 (.173)
_cons	2.252*** (.256)	2.118*** (.348)	2.24*** (.346)
Observations	353	201	152
R-squared	.099	.139	.14

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 4.3. GPA outcomes the semester during the course by modality

GPA and taking the course face to face are not significantly correlated overall nor before or during the pandemic.

GPA the Semester After and Modality			
	Overall GPA after	Pre-Pandemic GPA after	Pandemic GPA after

Face to Face Modality	.041 (.102)	.035 (.147)	.171 (.169)
_cons	2.366*** (.226)	2.399*** (.303)	2.3*** (.331)
Observations	298	170	128
R-squared	.083	.124	.163

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 4.4. GPA outcomes the semester after the course by modality

Results for the GPA during and GPA after are very similar; Though pre-pandemic scores were almost significantly correlated with GPA during, nothing is correlated for the semester after.

The next two areas of interest are retention and persistence. In the equation $Y = b_0 + b_1 + b_2 \dots b_{14} + E$, y is retention or persistence. Retention is described as reenrollment the next semester at LMCC. Persistence is defined as either reenrollment at LMCC, transfer to another school that semester or graduation. Persistence and retention are linked to GPA and as such offer an additional metric in determining if students find themselves capable and equipped (Pascarella & Terenzini, 2005). Online courses also suffer from a lack of social presence and as such, could impact students' sense of belonging according to Tinto (1975, 2006) and Astin (1997, 1999).

Retention and Modality:			
	Overall Retention	Pre-Pandemic Retention	Pandemic Retention
Face to Face Modality	.027 (.042)	.063 (.061)	.005 (.068)
_cons	.846*** (.08)	.8*** (.121)	.872*** (.106)
Observations	354	201	153
R-squared	.038	.042	.097

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 4.5. Retention defined as enrollment the following semester overall, correlated with modality.

Retention is insignificantly related to modality. Persistence is similar.

Persistence and Modality:			
	Overall Retain, Persist or Transfer	Pre-Pandemic Retain, Persist or Transfer	Pandemic Retain, Persist or Transfer
Face to Face Modality	.032 (.036)	.028 (.047)	.031 (.062)
_cons	.879*** (.065)	.854*** (.087)	.935*** (.096)
Observations	354	201	153
R-squared	.044	.035	.098

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 4.6. Persistence defined as reenrollment, transfer or graduation (or rtg) overall.

Overall, the modality of the course does not have any impact on the retention and persistence of students.

Discussion

Overall, modality is correlated most significantly and consistently with grades. Students who take the learning strategies course face to face achieve at least half a letter grade higher than their hybrid and online counterparts. This was consistent for pre-pandemic years as well. During the pandemic, this became slightly insignificant (at $p < 0.1$).

GPA is not significantly correlated, however. The purpose of including GPA was to extrapolate these results beyond the confines of the course to determine if the learning strategies had a differing impact on GPA as a result of the modality. It seems that the overall impact is non-existent or negligible, even if students' grades in the course are higher. Persistence and retention are not correlated with modality either.

Overall, the only firm conclusion that can be drawn is that grades are correlated with modality in normal, non-pandemic years. Students who are in-person are more likely to have higher course grades with coefficients of .68 and higher. In a scale of 4 points, that is a significant increase. Though this does not impact the students' GPA, the course is only worth one credit hour; So it is possible that our three credit hour courses could impact GPA more significantly, and as such, we should be aware of the potential harms and benefits modality could bring for developmental students.

Similarly, the persistence and retention data do not relate to modality, indicating that students are equally well served in both formats. This does not lend any credence to the assertion that social presence is necessary for retention and persistence, something that is a given in face-to-face classes but harder to recreate online (Astin, 1997; Richardson et al., 2017). Online courses in the learning strategies course are asynchronous with the exception of 14 students who took hybrid course modalities during the pandemic. Asynchronous courses are usually considered to

have a lack of social presence since there is no live, synchronous component in which students can connect with the professor and others. Even when excluding those 14, retention and persistence are not correlated with modality, which does not support the conclusions of Richardson et al. (2017) who argue that social presence, since it is linked with perceived learning, could impact persistence and retention.

However, the purpose of the learning strategies course is not explicitly to create a sense of belonging and community. It is possible with a cohort model or an emphasis on connection, these results would differ. It is also possible that the instructors in our online courses actually do create a sense of belonging that allows both modalities to have similar outcomes. Additionally, this course is the only course we know the modality of, so other courses in the students' program may be of differing modalities, thus impacting retention and persistence differently. As such, it would be irresponsible and incorrect to directly claim that this research refutes the value of belonging or social presence in retention and persistence. I can simply claim that this does not add to the support of that vein of research.

Chapter 5-Conclusions and Future Research

Overall, the learning strategies course does not significantly impact GPA for students who are transitioning to credit bearing coursework. However, it is clear that motivational traits in the form of attitude, concentration, motivation, test strategies and time management are correlated with higher GPA, and it is also clear that these self-reported measures increase after taking the course. Modality is not correlated with GPA outcomes.

Retention is significantly higher at the 95% confidence level for students who take the learning strategies course as opposed to students who did not take the course. However, retention is not correlated with any of the five LASSI categories, nor is it correlated with course modality.

Persistence is significantly higher for students who take the learning strategies course, and concentration, motivation, time management and test strategies LASSI scores are correlated with persistence, particularly during the Covid-19 pandemic. However, course modality is not significantly correlated.

As a result, I can recommend that we encourage students to take this course for its positive, though varied impacts. I would also encourage our faculty to focus on growth mindset and other positive attributions to assist students' self-efficacy and locus of control, which I believe is a key element in increasing persistence and retention. I would be interested to see how these outcomes differ if the course were mandatory and motivational, course selection elements were removed. It would also be useful to compare outcomes for course-takers in the overall developmental and general student population to those who do not enroll, rather than just students who are transitioning to credit bearing coursework. Further research is needed to evaluate utilizing courses like this to increase academic and psychological outcomes for students in our at-risk populations, such as developmental education, in other institutions with similar

course components. The discussion in guided pathways should include an evaluation of whether existing success coursework could be mobilized to fill the support gaps and reduce attrition.

However, further research is needed to support or refute that theory.

Some of the limitations of the current research as that selection on observables for the propensity score matching sample is not guaranteed. Though I put as many proxy variables in place as I had access to, motivational inventories like the LASSI, high school GPA or other metrics would have been useful if available for both groups. As with any self-report metric, it is possible that students do not have a clear perception of their own motivational traits which is an additional limitation of the LASSI study. Finally, though I can draw conclusions about the lack of correlation from our course modality to GPA, persistence and retention, I cannot conclude anything definitively about general online education versus face to face impacts since I do not know the modality of students' other courses.

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Appendix A - GPA, Retention and Persistence Outcomes With Propensity Score Matching

Linear multiple regression outcomes for GPA after, retention and persistence.

Linear Regression for GPA the Semester After

gpaafter	Coefficient	Standard Error	t-value	p-value	[95% Conf	Interval]	Sig
Recipient	-.005	.042	-0.13	.9	-.087	.077	
Black	-.088	.048	-1.82	.069	-.182	.007	*
Native American	-.078	.211	-0.37	.712	-.493	.337	
Hispanic	-.033	.038	-0.86	.388	-.108	.042	
Asian	.061	.057	1.06	.289	-.052	.173	
Pacific	-.019	.124	-0.16	.877	-.263	.225	
International	-.033	.058	-0.58	.565	-.148	.081	
No Race Reported	-.12	.062	-1.93	.053	-.241	.002	*
Two or More Races	-.114	.073	-1.55	.122	-.258	.03	
Age	.011	.002	4.49	0	.006	.015	***
Degree Seeking	-.009	.058	-0.15	.877	-.123	.105	
Received Pell	.044	.031	1.41	.158	-.017	.104	
Female	.004	.029	0.13	.899	-.053	.06	
Full Time Enrollment	.007	.03	0.25	.802	-.051	.065	
GPA Sem. Prior	.716	.018	39.95	0	.681	.751	***
Constant	.514	.089	5.78	0	.34	.689	***
Mean dependent var		2.747	SD dependent var			0.747	
R-squared		0.689	Number of obs			916	
F-test		132.742	Prob > F			0.000	
Akaike crit. (AIC)		1026.586	Bayesian crit. (BIC)			1103.706	

*** $p < .01$, ** $p < .05$, * $p < .1$

Table A.1. GPA the following semester for recipient as compared with all non-scholarship takers.

Linear Regression for Retention the Semester After

Retention the Next Term	Coefficient	Standard Error	t-value	p-value	[95% Conf	Interval]	Sig
Recipient	.125	.039	3.17	.002	.047	.202	***
Black	-.106	.04	-2.64	.008	-.185	-.027	***
Native American	-.198	.152	-1.30	.194	-.496	.1	
Hispanic	-.04	.033	-1.23	.22	-.105	.024	
Asian	.018	.052	0.34	.731	-.084	.12	
Pacific	.05	.115	0.43	.664	-.176	.276	
International	-.009	.052	-0.17	.868	-.111	.093	
No Race Reported	.086	.058	1.48	.139	-.028	.201	

Two or More Races	-.161	.058	-2.76	.006	-.275	-.047	***
Age	-.006	.002	-2.71	.007	-.01	-.002	***
Degree Seeking	.046	.05	0.92	.356	-.052	.144	
Received Pell	.058	.027	2.13	.034	.005	.112	**
Female	.01	.025	0.40	.692	-.04	.06	
Full Time Enrollment	.097	.026	3.77	0	.046	.147	***
GPA Sem. Prior	.118	.014	8.42	0	.09	.145	***
Constant	.366	.076	4.85	0	.218	.515	***
Mean dependent var		0.659	SD dependent var			0.474	
R-squared		0.102	Number of obs			1391	
F-test		10.377	Prob > F			0.000	
Akaike crit. (AIC)		1754.622	Bayesian crit. (BIC)			1838.427	

*** $p < .01$, ** $p < .05$, * $p < .1$

Table A.2. Retention the semester after taking the learning strategies course for recipients compared to non-scholarship takers

Linear Regression for retention, transfer or graduation rates

Retain, Transfer, Graduate	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]	Sig	
Recipient	.086	.037	2.33	.02	.013	.158	**
Black	-.038	.038	-1.00	.317	-.112	.036	
Native American	-.15	.143	-1.05	.294	-.43	.13	
Hispanic	-.031	.031	-1.00	.32	-.091	.03	
Asian	.043	.049	0.88	.381	-.053	.139	
Pacific	.061	.108	0.56	.574	-.152	.273	
International	-.028	.049	-0.58	.565	-.124	.068	
No Race Reported	.1	.055	1.82	.068	-.007	.207	*
Two or More Races	-.096	.055	-1.75	.08	-.203	.011	*
Age	-.004	.002	-2.20	.028	-.008	0	**
Degree Seeking	.011	.047	0.23	.821	-.081	.102	
Received Pell	.035	.026	1.34	.179	-.016	.085	
Female	.025	.024	1.04	.298	-.022	.071	
Full Time Enrollment	.104	.024	4.31	0	.057	.152	***
GPA Sem. Prior	.112	.013	8.48	0	.086	.137	***
Constant	.445	.071	6.26	0	.305	.584	***
Mean dependent var		0.731	SD dependent var		0.444		
R-squared		0.095	Number of obs		1391		
F-test		9.609	Prob > F		0.000		
Akaike crit. (AIC)		1578.099	Bayesian crit. (BIC)		1661.904		
*** $p < .01$, ** $p < .05$, * $p < .1$							

Table A.3. Retention, persistence or graduation outcomes for recipients as compared to non-scholarship takers

Appendix B - Motivation as Measured by the LASSI for Developmental Education Students in a Learning Strategies Course

SCATTER PLOTS FOR TWO SAMPLE T-TESTS ON PRE AND POST-TEST LASSI SCORES AND FOR
GPA BEFORE AND AFTER THE SEMESTER OF INTEREST.

Scatter Plots of Pre and Post Test Scores and GPA prior and post semester

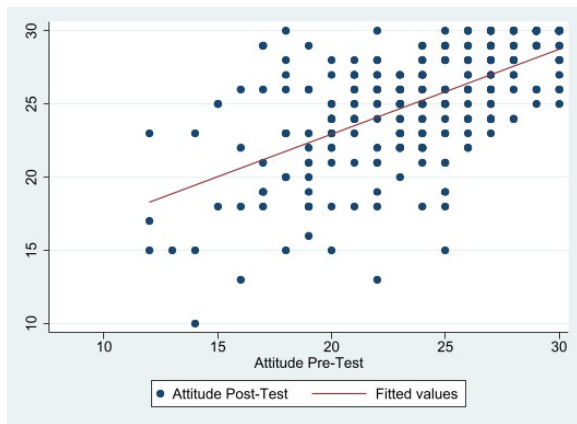


Figure B.1. Scatter for Attitude Pre and Post-Test Scores

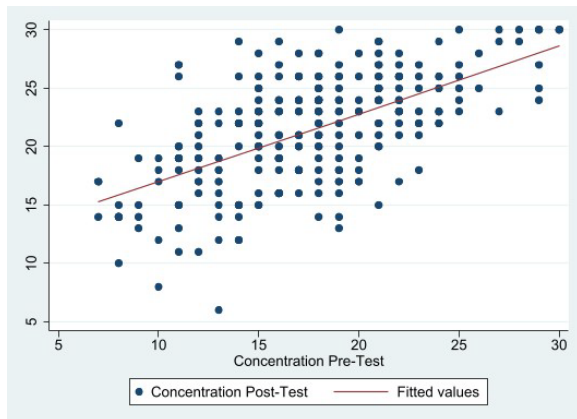


Figure B.2. Scatter for Concentration Pre and Post-Test Scores

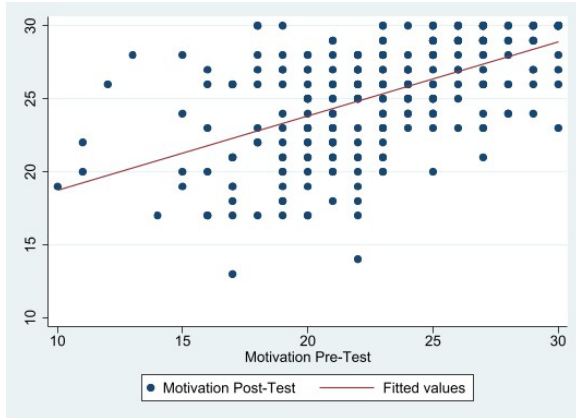


Figure B.3. Scatter for Motivation Pre and Post-Test Scores

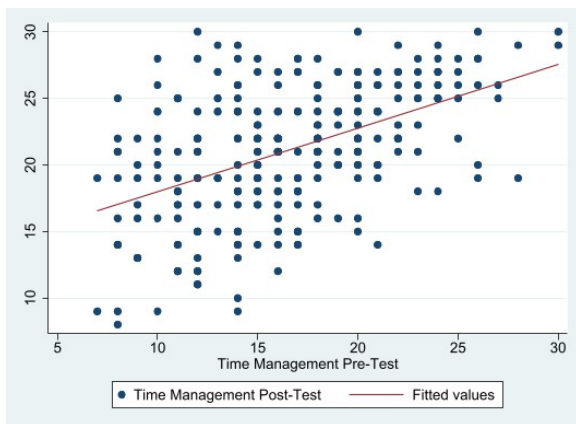


Figure B.4. Scatter for Time Management Pre and Post-Test Scores

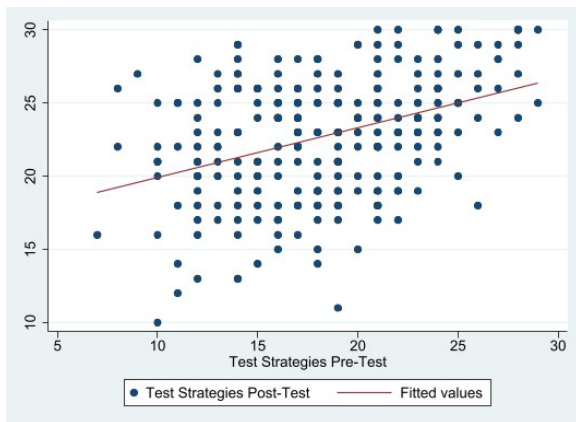


Figure B.5. Scatter for Test Strategies Pre and Post-Test Scores

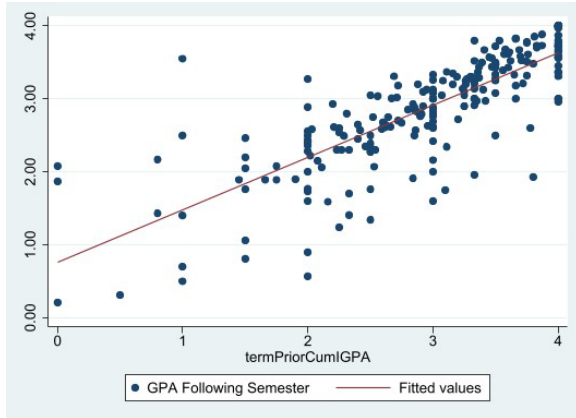


Figure B.6. Scatter for GPA Prior Semester and Post

Comparison of Age and Pell Grant Status for Developmental and Non-Developmental Students

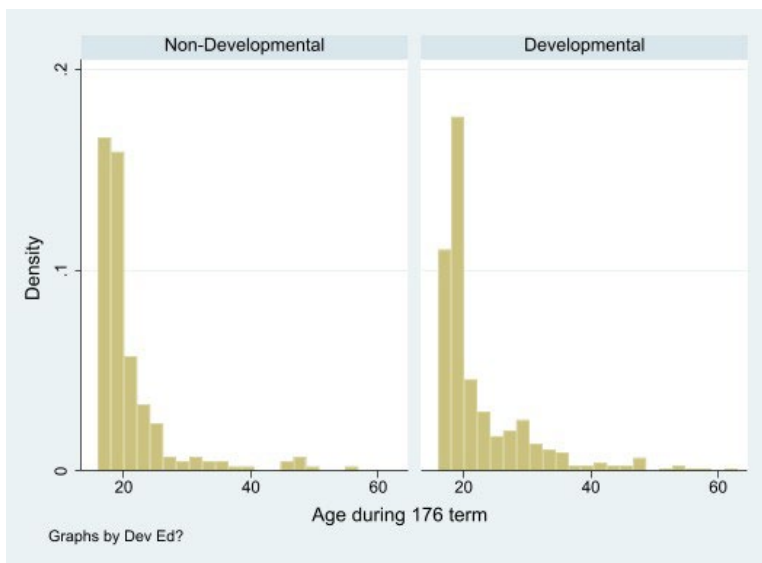


Figure B.7. Age difference for Developmental and Non-Developmental Students

Pell Grant Difference Between Non-Developmental and Developmental Students

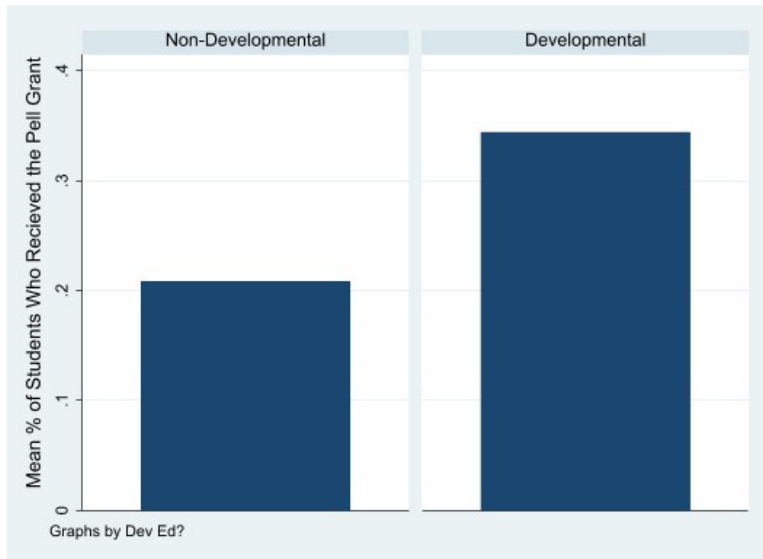


Figure B.8. Pell Grant Recipients By Non-Developmental or Developmental Status

Pre-Pandemic and Pandemic LASSI Scores Charts: All and Non-Developmental

GPA After for All Students, Pre Pandemic

	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.038** * (.012)									
Attitude Post-Test		.013 (.013)								
Concentrat ion Pre- Test			.033** * (.011)							
Concentrat ion Post- Test				-.003 (.012)						
Motivation Pre-Test					.048** * (.013)					
Motivation Post-Test						.048** * (.013)				
Test Strategies Pre-Test							.045** * (.011)			
Test Strategies Post-Test								.055** * (.016)		
Time Manageme nt Pre-Test									.031** * (.009)	
Time Manageme nt Post- Test										.012 (.01)
_cons	1.785* **	2.345* **	2.052* **	2.698* **	1.536* **	1.476* **	1.578* **	1.385* **	2.113* **	2.422* **

	(.307) 245	(.365) 205	(.263) 245	(.361) 205	(.319) 245	(.414) 205	(.312) 245	(.434) 205	(.252) 245	(.329) 205
Observations										
R-squared	.14	.113	.141	.109	.162	.156	.166	.176	.144	.114
<i>Robust standard errors are in parentheses</i>										
*** $p < .01$, ** $p < .05$, * $p < .1$										

Table B.1. LASSI and GPA for total population before pandemic

GPA After for All Students, During Pandemic										
	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.022* (.013)									
Attitude Post-Test		-.016 (.016)								
Concentration Pre-Test			.024** (.011)							
Concentration Post-Test				.015 (.012)						
Motivation Pre-Test					.069* ** (.014)					
Motivation Post-Test						.058* ** (.019)				
Test Strategies Pre-Test							.037** * (.011)			
Test Strategies Post-Test								.011 (.015)		
Time Management Pre-Test									.035** * (.01)	
Time Management Post-Test										.018 (.011)
_cons	1.839*	2.499*	1.928*	1.934*	.953*	.829*	1.634*	1.951*	1.778*	1.873*

	**	**	**	**	**		**	**	**	**
	(.343)	(.395)	(.279)	(.309)	(.338)	(.448)	(.304)	(.383)	(.26)	(.286)
	222	160	222	160	222	160	222	160	222	160
Observations										
R-squared	.196	.259	.203	.261	.272	.308	.219	.257	.221	.265

Robust standard errors are in parentheses
*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.2. LASSI and GPA for total population during pandemic

GPA After for Non-Developmental Students, Before Pandemic										
	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.055*									
	(.029)									
Attitude Post-Test		.027								
		(.023)								
Concentration Pre-Test			.025							
			(.018)							
Concentration Post-Test				-.021						
				(.025)						
Motivation Pre-Test					.061***					
					(.018)					
Motivation Post-Test						.058**				
						(.023)				
Test Strategies Pre-Test							.06**			
							(.023)			
Test Strategies Post-Test								.053*		
								(.029)		
Time Management Pre-Test									.043**	
									(.019)	
Time Management Post-Test										.005
										(.026)
_cons	1.245	2.03**	2.082**	3.002**	1.241**	1.342*	1.103	1.483*	1.932**	2.569**
	*	*	*	*	*	*	*	*	*	*

	(.69) 70	(.545) 61	(.412) 70	(.585) 61	(.441) 70	(.639) 61	(.614) 70	(.64) 61	(.393) 70	(.537) 61
Observations										
R-squared	.289	.275	.263	.268	.336	.321	.325	.309	.297	.259
<i>Robust standard errors are in parentheses</i>										
*** $p < .01$, ** $p < .05$, * $p < .1$										

Table B.3. GPA and LASSI Correlations for Non-Developmental Students before Pandemic
GPA After for Non-Developmental Students, During Pandemic

	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After	GPA Sem. After
Attitude Pre-Test	.009 (.021)									
Attitude Post-Test		-.01 (.027)								
Concentration Pre-Test			.011 (.019)							
Concentration Post-Test				.004 (.018)						
Motivation Pre-Test					.077** * (.02)					
Motivation Post-Test						.052* * (.025)				
Test Strategies Post-Test							.042 (.028)			
Test Strategies Pre-Test								.013 (.015)		
Time Management Pre-Test									.031** (.015)	
Time Management Post-Test										.019 (.014)
_cons	1.691**	2.473**	1.723**	2.223**	.77	1.159	1.424	1.638**	1.57**	1.959**

	*	*	*	*		*	*	*	*
	(.639)	(.734)	(.561)	(.513)	(.547)	(.715)	(.755)	(.613)	(.493)
	92	61	92	61	92	61	61	92	92
Observations									61
R-squared	.407	.445	.408	.444	.503	.486	.473	.408	.43
<i>Robust standard errors are in parentheses</i>									
*** $p < .01$, ** $p < .05$, * $p < .1$									

Table B.4. GPA and LASSI correlations for Non-Developmental Students during Pandemic

Retention Pre-Pandemic and Pandemic: Total and Non-Developmental

Retention for All Students, Before Pandemic

	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain
Attitude Pre-Test	.01 (.006)									
Attitude Post-Test		.001 (.005)								
Concentration Pre-Test			-.006 (.005)							
Concentration Post-Test				0 (.005)						
Motivation Pre-Test					.006 (.006)					
Motivation Post-Test						.011 (.007)				
Time Management Pre-Test							.001 (.004)			
Time Management Post-Test								.002 (.005)		
Test Strategies Pre-Test									-.001 (.005)	
Test Strategies Post-Test										.001 (.006)
_cons	.586** * (.158) 288	.743** * (.159) 232	.851** * (.124) 288	.764** * (.152) 232	.657** * (.158) 288	.52** * (.198) 232	.749** * (.115) 288	.73** * (.141) 232	.781** * (.155) 288	.749** * (.188) 232
Observations										
R-squared	.081	.089	.077	.088	.074	.102	.071	.09	.07	.088

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.5. Retention and LASSI scores for all students before pandemic.

Retention for All Students, During Pandemic										
	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain
Attitude Pre-Test	.003 (.006)									
Attitude Post-Test		.001 (.005)								
Concentratio n Pre-Test			.005 (.005)							
Concentratio n Post-Test				.007 (.006)						
Motivation Pre-Test					.006 (.006)					
Motivation Post-Test						.018* * (.009)				
Time Management Pre-Test							.006 (.005)			
Time Management Post-Test								.005 (.005)		
Test Strategies Pre-Test									.003 (.006)	
Test Strategies Post-Test										.01 (.006)
_cons	.67** * (.163) 281	.743** * (.159) 232	.662** * (.133) 281	.889** * (.144) 188	.603** * (.164) 281	.593* * (.229) 188	.644** * (.131) 281	.916** * (.138) 188	.681** * (.145) 281	.808** * (.159) 188
Observations										
R-squared	.08	.089	.082	.113	.083	.136	.084	.11	.079	.117

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.6. Retention and LASSI scores for all students during pandemic.

Retention for Non-Developmental Students, Before Pandemic

	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain
Attitude Pre-Test	.007									
	(.012)									
Attitude Post-Test		.007								
		(.008)								
Concentration Pre-Test			-.004							
			(.008)							
Concentration Post-Test				-.001						
				(.009)						
Motivation Pre-Test					.005					
					(.009)					
Motivation Post-Test						.01				
						(.011)				
Time Management Pre-Test							.006			
							(.007)			
Time Management Post-Test								.009		
								(.011)		
Test Strategies Pre-Test									.009	
									(.009)	
Test Strategies Post-Test										.005
										(.008)
_cons	.678**	.599**	.863***	.761***	.735***	.539*	.753***	.61**	.643**	.637**
	(.308)	(.266)	(.205)	(.238)	(.257)	(.322)	(.194)	(.248)	(.262)	(.276)
Observations	82	70	82	70	82	70	82	70	82	70
R-squared	.308	.385	.307	.381	.307	.39	.31	.392	.314	.383

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.7. Retention and LASSI scores for non-developmental students before pandemic

Retention for Non-Developmental Students, During Pandemic

	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain	Retain
Attitude Pre-Test	.001 (.011)									
Attitude Post-Test		.007 (.008)								
Concentratio n Pre-Test			.003 (.009)							
Concentratio n Post-Test				.011 (.011)						
Motivation Pre-Test					.004 (.011)					
Motivation Post-Test						.038* * (.014)				
Time Management Pre-Test							.001 (.008)			
Time Management Post-Test								.002 (.009)		
Test Strategies Pre-Test									.005 (.01)	
Test Strategies Post-Test										.033* * (.014)
_cons	.734* * (.281) 124	.599* * (.266) 70	.718** * (.235) 124	.962** * (.267) 78	.693** * (.264) 124	.3 (.385) 78	.743** * (.22) 124	1.093** * (.248) 78	.682** * (.257) 124	.467 (.36) 78
Observations										
R-squared	.197	.385	.198	.256	.198	.341	.197	.241	.199	.313

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.8. Retention and LASSI scores for non-developmental students during pandemic

Persistence and LASSI Scores Pre-Pandemic: Total and Non-Developmental

Persistence for All Students, Before Pandemic

		Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate	Retain Transfer Graduate
Attitude Pre-Test	.005 (.005)									
Attitude Post-Test		.002 (.004)								
Concentration Pre-Test			-.003 (.004)							
Concentration Post-Test				.004 (.003)						
Motivation Pre-Test				.002 (.004)						
Motivation Post-Test					.011* (.006)					
Test Strategies Pre-Test						0 (.004)				
Test Strategies Post-Test							.006 (.004)			
Time Management Pre-Test								-.003 (.003)		
Time Management Post-Test									.003 (.003)	
_cons	.85** * (.124) 288	.894** * (.125) 232	.982** * (.09) 288	.873** * (.109) 232	.906** * (.114) 288	.671** * (.171) 232	.933** * (.1) 288	.816** * (.122) 232	.975** * (.078) 288	.886** * (.102) 232
Observations										
R-squared	.047	.078	.046	.081	.043	.108	.042	.084	.045	.081

Robust standard errors are in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.9. Persistence for all students before pandemic

Persistence for Non-Developmental Students, Before Pandemic										
	Retain Transfer Graduate		Retain Transfer Graduate		Retain Transfer Graduate		Retain Transfer Graduate		Retain Transfer Graduate	
Attitude Pre-Test	.003 (.007)									
Attitude Post-Test		.004 (.007)								
Concentrat ion Pre- Test			.001							
Concentrat ion Post- Test			(.004)	.002						
				(.006)						
Motivation Pre-Test					.005					
					(.006)					
Motivation Post-Test						.011				
						(.011)				
Test Strategies Pre-Test							0			
							(.006)			
Test Strategies Post-Test								-.007		
								(.004)		
Time Manageme nt Pre-Test									0	
									(.004)	
Time Manageme nt Post- Test										.005
										(.009)
_cons	1.119* ** (.234) 82	1.013* ** (.253) 70	1.167* ** (.164) 82	1.074* ** (.203) 70	1.087* ** (.181) 82	.865* ** (.319) 70	1.182* ** (.189) 82	1.232* ** (.184) 70	1.184* ** (.147) 82	1.027* ** (.227) 70
Observatio										

ns										
R-squared	.325	.34	.323	.336	.332	.372	.323	.346	.323	.345

Robust standard errors are in parentheses
*** $p < .01$, ** $p < .05$, * $p < .1$

Table B.10. Persistence for non-developmental students before pandemic