

DOES MANDATORY SUPPLEMENTAL INSTRUCTION WORK IN
DEVELOPMENTAL MATH EDUCATION?
A STUDY OF STUDENTS ENROLLED IN
DEVELOPMENTAL MATH COURSES
AT A SUBURBAN COMMUNITY
COLLEGE IN THE NORTHEAST

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ABSTRACT

The number of students entering the community college in need of developmental math has not changed, remaining at a steady 60% over the past seven years. This study compared the success rate of Mandatory Supplemental Instruction (MSI) sessions within four sections of a developmental math course compared with the success rates of students enrolled in both the Traditional Classroom setting and the Individualized format at Suburban Community College (SCC) during the Fall 2009 semester. These MSI format courses were compared with both the Individualized format of MAT 060 and the Traditional Classroom format of the same course. The students included in these sections were a combination of students who were: 1) suggested by advisors to enroll in this developmental math course after receiving a low score on the college's Accuplacer placement test for algebra or continuing the progression of developmental math from the lower level arithmetic class; 2) mandated to attend MSI after successful completion of the Jump Start Math Program, or 3) self-selected into the MSI group anticipating the need for additional help in the course. The two primary data sets available for this study are student math final grades and student participation/attendance records. Secondary sets of data include informal focus group notes, final exam scores, student attendance records for both class lectures and MSI sessions, and Supplemental Instruction Leader anecdotal records.

The findings of this study conclude that success rates of students enrolled in the MSI sections of developmental math do not differ significantly from those enrolled in the Traditional Classroom format of developmental math; however, both groups did differ significantly from the Individualized format of developmental math, in that the students

enrolled in the Individualized format succeeded at a lesser rate and withdrew at a greater rate than their MSI or Traditional Classroom counterparts. This study also concluded that female, full-time students succeeded at a greater rate across the board, which is consistent with the literature.

These findings were significant for a number of reasons. Although the difference between the treatment group and the Traditional Classroom group was not significant, there are a variety of reasons at the program level as to why this may have been so and there are many future constructs that SCC can put in place to strengthen and reassess the MSI program. Although this study was focused on the MSI treatment, the data revealed a greater issue existing in the Individualized format of developmental math at SCC. Future considerations can be made in this particular delivery method to improve success rates of students involved in this program. Future research on MSI in the form of persistence and retention rates, graduation rates, transfer rates, subsequent math course grades and success in other college-level classes can be explored to provide the MSI program with more data to determine if particular groups of students are benefiting from this format.

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CHAPTER 1

INTRODUCTION

The steady need for developmental math education at the community college illuminates the problem of poor high school preparation that has not been solved, despite many attempts to improve community college math performance (Markus & Zeitlin, 1993). More than half of all community college students test into developmental math and out of this percentage, many go on to fail the course, withdraw from the course or simply fail to finish the course in the allotted time frame given by the college. This study will give some insight into one possible support for developmental mathematics by examining Mandatory Supplemental Instruction (MSI) sessions for developmental math courses at a suburban community college. In order to determine if students achieve a greater rate of success with MSI, an experimental design comparing a control group with the treatment group will be used.

The specific question asked in this research is whether or not MSI works in developmental math education and produces greater student success in certain populations? An additional question is whether MSI is equally effective for all students in relation to student characteristics such as age, race, initial math placement test scores and gender.

This study was conducted in response to a wealth of literature highlighting the need for greater success rates in developmental math education at Suburban Community College (SCC). Although a large number of students require developmental math education courses, far too few actually succeed in passing, thus impeding their chances at future success in education and a career. This handicap does not solely affect students, but also impacts the efficiency of CCS and the development of a strong workforce.

Statement of the Problem

The number of incoming college freshmen who are required to take one or more developmental math courses at the community college is not decreasing. “Developmental [math] education grew until it leveled off in the 1990s” and is offered at a stable rate today (Cohen and Brawer, 2008, p. 292). Depending on the state, developmental math education enrolls between 40 and 70 percent of first year students at two-year colleges. As reported by Cohen and Brawer (2008), “Nationwide, 44 percent of first-time community college students enroll in between one and three developmental courses, 14 percent in more than three” (p. 291). Therefore, more than half of incoming college freshmen at the community college are in need of developmental math education.

Although the high level of need for developmental math education is a significant problem alone, the larger and even more pressing problem is that the students enrolled in these courses frequently withdraw or fail out before earning even a single college credit. According to an analysis of the data available through the National Achieving the Dream Database, less than 25% of the students at the colleges participating in the initiative “who placed into a remedial math course in academic 2002-3 had finished their precollege math requirements three years later” (Blum, 2007, p. 62). In comparing the two data sets, the data show that only 25% of students already placed in that “disadvantaged half of students” in need of developmental education ever go on to receive a college credit, let alone a two-year or four-year college degree.

At Suburban Community College (SCC), the percentage of students placing into developmental math is comparable to the national average. Of the first year student

population, 60.3% of students place into developmental math. Of the 60.3% of students who place in and take a developmental math course at Suburban Community College, 62.6% of these students are successful in persisting in the course and receiving a passing grade in the end. Although SCCs pass rates are well above the national average, the problem remains that nearly 40% of students required to take a developmental math course at SCC fail to finish their precollege math requirement thus eliminating any possibility of achieving a two-year or four-year degree or admission into certain special selective admission programs.

Students who score into developmental math courses are further restricted in their options at the community college because these developmental courses act as “gate-keeper” courses, restricting students’ access to certain programs, courses requiring a pre-requisite and in an increasing number of cases, entire colleges or universities. According to Cohen and Brawer (2008), “the nation’s community colleges moved toward a system of placement testing [which] restricted admissions to many courses and programs [and] more than half the states have regulations governing remedial instruction. Some have mandated that it not be offered in the public universities” (p. 293). These students already identified as being at an academic disadvantage are met with more obstacles along the way that dictate what courses they can take, what programs they can be admitted into and what colleges and universities that can (or cannot) attend.

There have been many attempts to remedy the developmental math success problem in the past. Some institutions have adopted a mentoring program where developmental math students are paired with a peer or faculty mentor in order to provide additional support for the student and possibly increase that student’s chance at math success (Scott &

Homant, 2007). Other institutions have adapted the delivery of developmental math education to include abbreviated courses, extended courses and various course delivery modes (Blum, 2007). Yet others have paired developmental math with auxiliary courses, seminars or interactive software programs on topics such as time management, note-taking, math anxiety and test preparation (MacDonald & Caverly, 1999).

Suburban Community College has utilized and implemented many of the aforementioned strategies and more. Developmental math students have access to a Math Lab complete with computers, printers, math computer software, math DVDs/videos, peer tutors, areas for study groups and more. Another attempt to assist this population is with Act-101 tutoring where students are provided with one-on-one professional math tutoring by weekly appointments. To further assist students placed into developmental math courses, SCC offers these courses in an individualized format so that students can proceed at their own pace – slowing down for the more difficult material and speeding through already mastered sections. Other programs such as the summer bridge program and seminars offered throughout the semester have all been put in place to assist this student population.

Two weeks prior to the start of the Fall 2009 semester, the newly created Jump Start Math program, a program designed for the lowest level of developmental math students, was implemented. In the Jump Start Math Program, students who had taken the placement test and placed into the upper 25% of the score indicating the need for the lowest level of developmental math, or MAT 040, were invited into this program. Through an intensive, nine-day program, students were given a review of the arithmetic on the placement test and an introduction to college life and students services at SCC. At the end of the program, all

students were given the opportunity to retake the math portion of the placement test and thus, have the opportunity to place into the next level of developmental math, or MAT 060. If students placed into MAT 060 after taking the Jump Start Math Program, they were obligated to sign up for a MAT 060 course with a MSI section attached.

Despite attempts made both nationally and by SCC to support students and aid in their success in developmental mathematics, this problem with high failure rates in math courses still remains. There is an urgent need to explore and test other strategies to aid in developmental math student success so that more students have access to postsecondary education completion and the opportunity to achieve their goals and dreams. One possible way is through the aforementioned MSI for developmental math students.

Purpose of the Study

In the “pure” form of Supplemental Instruction, students are given the option to attend the Supplemental Instruction sessions that follow the normal in-class developmental math class meetings. Therefore, if SCC followed this “pure” form of Supplemental Instruction, students could have opted not to attend SI sessions. However, at SCC, Supplemental Instruction has been mandated for a selected group of students. This study offers some insight on whether mandating Supplemental Instruction for a selected group of developmental math students improves student math scores and helps students matriculate to “for credit” courses. This selected group of students consists of students who scored within a certain range on the placement test, students who were required to take Basic Math and students who participated in an accelerated form of Basic Math during the previous summer. Those students who are repeating Developmental Math for the second, third, fourth and, in some cases, the fifth time were also suggested for MAT 060 with MSI. Not

all of these students were required to participate in MSI. Students included in these groups who did not end up taking the MSI section of MAT 060 could have opted out of taking those specific sections. Those students who participated in the Jump Start Math Program and mandated to take MSI with MAT 060 could, under extreme circumstances, opt out of the MSI section and could instead seek weekly tutoring with a professional math tutor.

This research determined whether the experimental treatment (Mandatory Supplemental Instruction), improves student scores. These data were examined in terms of student success compared among MSI, Traditional and Individualized formats of MAT 060. Further analyses were conducted to determine if certain student characteristics also play a role in student success and, if so, to what extent. Student success was defined in terms of student grades (Pass and High Pass vs. No Pass and Withdrawal).

Considerable literature on developmental math and supplemental instruction fail to include or even suggest the use of mandatory Supplemental Instruction in developmental math. As previously mentioned, the “pure” form of Supplemental Instruction discourages institutions and programs from making Supplemental Instruction a mandatory addition to a course. In addition, “pure” Supplemental Instruction literature discourages the use of Supplemental Instruction in developmental courses because of the nature of the developmental student and the low attendance rate when made optional.

This study determined whether the addition of MSI in an historically difficult gate-keeper course can improve the retention rate and final achievement level of students.

Research Questions

- (1) Does the inclusion of the mandatory supplemental instruction have a significant impact on student grades and MSI attendance?
- (2) Can success in MAT 060 be predicted from demographic and other variables?

Definitions

ACT 101 Tutoring – a program for residents of Pennsylvania who are educationally underprepared and who need financial assistance to prepare them for college-level courses. Its purpose is to provide educational support services to strengthen academic skills and increase confidence in the student's ability to achieve. Students participating in Act 101 have the unique opportunity to improve their skills in English, reading and mathematics before starting the regular college experience.

Individualized Developmental Math – students assigned to developmental math courses at SCC are given the option to take the course in an individualized setting where a student can work at his or her own pace through the course.

Jump Start Math (JSM) – an accelerated version of the basic math, or MAT 040 course, where students placing into the upper quarter of basic math are invited to participate in this summer arithmetic refresher course and may then re-take the placement test and, hopefully, test into the higher developmental math course.

Mandatory Supplemental Instruction (MSI) – a mandatory support for students enrolled in specific developmental math courses that offers two additional hours of math strategies, study skills, and “how to do college” success strategies. These sessions are led by a graduate student who sits through each class meeting with the group of students and who has general knowledge of the math content offered in this course.

MAT-040- The lower in the sequence of two developmental math courses at SCC focusing on basic arithmetic. Students successfully completing MAT 040 must take MAT 060 before being able to take any “for credit” math courses.

MAT-060 – A developmental math course focusing on elementary algebra. This course is the second in a sequence of two developmental courses offered at SCC.

Placement Test – a standardized test that all students take upon entering Suburban Community College. This test determines if a student is in need of remediation (and assigned to a developmental math course) or if the student’s math abilities are on par for college for-credit math courses. The placement test used by SCC is a nationally used test called the *Accuplacer Exam*.

SCC Instrument – a specially created survey of student engagement that was created by the success committee at SCC. This survey was administered to all students taking a developmental math course.

Delimitations and Limitations of This Study

Due to the nature of this specific study, this study may not apply to other institutions offering the “pure” model of Supplemental Instruction. Because the developmental math students being examined in this study are attending Supplemental Instruction in a mandatory format, the findings may not generalize to institutions offering Supplemental Instruction in an optional format.

In addition, this study may not be applicable to Supplemental Instruction sessions offered outside of developmental math education courses. The sessions that the students attended included a considerable amount of math strategy and success initiatives that are

described in the developmental math literature as best practices for this course and this population of students.

Students included in the MSI group are not a random sample. In some cases, faculty advisors suggested that a particular student enroll in a developmental math section assigned the MSI component. In other cases, students participating in the Jump Start Math Program were mandated to participate in the Mandatory Supplemental Instruction section of MAT 060 and were assigned to a particular section by the director of the program. Other students were wrongly advised and told that the additional two hour component of this course was optional and some advisors admitted to not knowing why an additional two hours were assigned to these particular courses. Another group of students signed up for the course without the assistance of an advisor or counselor and failed to notice the additional two hours on their schedule. A detailed description of the sampling will be given in the methodology section.

Finally, in examining the structure of this program at SCC, this study may not apply to Supplemental Instruction sessions/programs being offered in other historically difficult courses outside of math. The strategies being used for the program are specifically designed for mathematics and would not necessarily apply to other subjects.

The large suburban community college that is piloting the MSI program was chosen due to the researcher's need for a community college mandating Supplemental Instruction for developmental math.

Significance of the Study

After focusing much of my research throughout my doctoral-level courses and studies on developmental education, it has been frustrating to read the literature and

statistics, both contemporary and dating back to the early 1900s, explaining and highlighting the continuing need for developmental math education courses and describing how this need has not been met in the past. More recently, what has been even more frustrating is hearing the stories directly from students who need to take one or more developmental course and seeing some of these students fail at their attempt to understand and successfully pass the developmental math course. As stated by Cohen and Bower (2008), “two options are not acceptable: allowing sizable percentages of students to fail and reducing academic standards so that those who do get through have not been sufficiently well prepared to succeed in the workplace or in further education” (p. 310).

Although a great deal of the literature explores the disadvantages to individual students and their access to education and opportunity, the substantial lack of student success in developmental math education courses presents many problems that extend beyond the individual student.

Apart from eliminating many educational and career options for students, developmental math education is offered at a cost not only to the individual, but also to the public. Cloud (2002), reports that “taxpayers spend approximately \$1 billion a year on the [developmental] classes” and because the taxpayers are already funding K-12 education, some argue that “we pay twice to teach some people the rudiments” (p. 60). In other words, taxpayers pay for the same student to be educated in the same material twice – once in high school and once again at the community college. Apart from the cost felt by the taxpayers, the cost to individual students includes exhausting financial aid monies as students may need to spend this much-needed funding on non-credit developmental math education courses.

This national view of the cost and implications as a result of the lack of student success in developmental math education is visible at Suburban Community College. Students at SCC who fail developmental math do not go on to take any credit math courses. Because of pre-requisites assigned to many courses at SCC, these same students are prohibited from taking many other courses in other fields such as sciences and the humanities. The successful completion of developmental math courses is a mandatory pre-requisite at SCC for admission into many programs such as nursing and core-to-core transfer to a four-year college or university. Therefore, a student's failure to pass developmental education greatly limits the options of this student. Students can either try and try again or discontinue their education at the community college.

Furthermore, the majority of research written on Supplemental Instruction provides the reader with statistics and findings from studies where Supplemental Instruction is used in its "pure" form – voluntary and with specified classes. The goal of this research is to look at Supplemental Instruction when it is offered on a mandatory basis and with MAT 060, or developmental math – a discipline in which the experts on Supplemental Instruction warn against using with.

CHAPTER 2

REVIEW OF THE LITERATURE

Developmental Math Education

Developmental education, also known as remedial education, is “an educational support intended to provide under-prepared, incoming students of higher education with the skills necessary to succeed in college and gain employment in the labor market” (Bettinger & Long, 2005, p. 19). “Although the term remedial has acquired a history of negative overtones that makes it unpopular with college educators, it continues to be used by the general public, policymakers, and media” (AACC Board of Directors, 2000, p. 1).

Developmental education is hardly a new concept at community colleges. As early as 1851, Henry Tappan “first proposed the concepts of junior colleges as a means of relieving colleges and universities of the burden of under-prepared freshmen” (Markus & Zeitlin, 1993, p.1). Nearly 60 years later, more than 350 institutions of higher education formed college preparatory departments with the sole responsibility of trying to improve the basic skills of under-prepared high school students (Markus & Zeitlin, 1993). It was between the years of 1930 and 1939 that “colleges began to establish formal remedial programs” (Markus & Zeitlin, 1993, p.3). According to Cohen and Brawer (1996), developmental education “has come to the fore after decades of being treated as an embarrassing secret, as something that the colleges did but that their leaders would rather not publicize” (p.436).

In reflecting upon the last 30 years in higher education developmental education, Boylan and Bonham (2007) highlight the changes that have been made in dealing with developmental education. “Few people were discussing developmental education at the

state or national levels” (Boylan & Bonham, 2007, p.2). They write that, “If legislators talked about developmental education, they usually talked about eliminating remedial courses or relegating them to the community colleges” (Boylan & Bonham, 2007, p. 2). More recently, greater effort has been made to both recognize and support developmental education. In 1982, South Carolina was the first state to establish an association of developmental education, which “paved the way for 28 more state and regional organizations to affiliate with the association” (Boylan & Bonham, 2007, p. 3). In 1986, the first doctoral program in developmental education was established at Grambling State University and six years later, NADE developed a certification program for those already involved with developmental education (pp. 3-4). At present, many individual states are involved in state-wide efforts aimed to improve developmental education. It may have taken 30 years for this progress, but “these and other actions represent a trend toward state legislators and higher education executive officers recognizing the importance of developmental education to the success of higher education” (Boylan & Bonham, 2007, p. 4).

To determine a student’s placement in or beyond a developmental course, many institutions use standardized placement tests for math, writing and reading. The national research conducted by the American Association of Community Colleges “indicated that 58 percent of institutions required assessment for all students [and] the institutions used a variety of criteria to exempt students from required participation in assessment testing” (Shults, 2000). These exemptions included high college entrance exam scores, high school GPA, statewide high school exam, AP scores, and transfer status or any combination of these (Shults, 2000). Institutions also reported varying ways of assessing the students for

placement. The most common method of delivering the placement test was computerized assessment measures, but other methods included paper and pencil, standardized college entrance exams, institutionally developed measures and state-developed measures (Shults, 2000).

Developmental education is currently organized in one of three ways: centralized, mainstreamed and through one academic department (such as English) within the two-year college. When centralized, developmental education, “is offered in a separate department whose sole function is to offer pre-college level courses.” (Perin, 2002, p.1). In centralized departments, institutions, “may offer both [developmental] courses and ancillary support services such as counseling and tutoring” (Perin, 2002, p.1). When mainstreamed, “pre-college level remedial courses are offered in academic departments, whose main purpose is to offer courses applicable to associate degrees or certificates” (Perin, 2002, p.1). Only a small percentage of institutions offer developmental education through one academic department (Shults, 2000). Pros and cons are stated for both situations, but the research suggests that students had higher grade point averages when participating in a centralized program (Perin, 2002).

Students participating in developmental education are students identified as academically under-prepared for college level work (Saxon & Boylan, 2001). In addition, these students are also typically financially disadvantaged, providing for themselves financially on a salary of less than \$20,000 per year. The average High School GPA is 2.40 and half of students in developmental education earn a score of 800 or less on the SAT test, further demonstrating the under-preparedness of students within the program.

The location of the institution tends to impact remedial enrollment in that “the highest percentage of students enrolled in remedial courses by region was in the southwest” (Shults, 2000, p. 3). Unfortunately, of all of the students participating in developmental education, less than half initially enrolled ever complete the remedial coursework, let alone a degree (Cohen & Brawer, 1996).

Half of the students are successful in completing the developmental education courses. In one study completed by the Ohio Board of Regents, it was found that females were more likely to complete developmental courses than males, younger students were more likely to succeed than older students and white and Asian students completed at higher rates than their black or Hispanic peers (Bettinger & Long, 2005). In addition, students who completed their remedial courses had higher ACT scores, more semesters of high school math, and higher high school math GPAs.

Student characteristics are not the only deciding factor in predicting success in developmental education classes. Timing is also a factor. One study showed that students who delay taking developmental math in their first semester do significantly worse, in that they earn significantly lower GPAs (Johnson & Kuennen, 2004). This study not only looked at the student GPA for the developmental math course, but included information on students’ other courses – courses that “develop students’ ability to apply knowledge gained in one situation to solve problems in another, such as using mathematics skills in non-mathematics courses that have quantitative, problem-solving, logical, or abstract component” (Johnson & Kuennen, 2004, p. 24). Students who shoved the necessary developmental math courses to the forgotten corner when beginning higher education were

ill prepared for other courses that included math and reasoning skills thus perpetuating the low rate of success across the board.

Other research suggests that the number of developmental education courses needed by a student has a direct relationship with a student's likelihood to drop out. Hoyt (1999) observed that, "as the number of remedial areas increased for students at the college, their drop-out rates consistently increased. In other words, higher remediation rates had a negative relationship with student retention." (p. 56). This observation is highly troubling in looking at the data presented in a Community College Research Association Research Brief reporting that the "average number of credit hours taken in remedial coursework ranged from 2 to 30, with one institution reporting an average of 41" (Shults, 2000, p.3).

The placement test taken by students may also have an effect on student success and persistence. Jacobson (2006) conducted a study regarding placement test difficulty and student success and completion of developmental math courses. After implementing a more difficult placement test to judge student placement in either basic arithmetic, developmental algebra or college-level courses, one institution made the observation that the placement test they had adopted might be too easy, thus admitting ill prepared students into courses that were not appropriate for their lower math abilities. At the completion of this study, Jacobson (2006) reported that, with the more difficult placement test, results suggested that students were done a great service. Success of students in the developmental math courses increased, retention of students in these courses increased and "once students have started to take courses, they reenroll in the next course at a higher rate [and] this may be related to the higher success rates in the 2002 cohort" (Jacobson, 2006, p. 155). When students were accurately placed in developmental math courses, they were

better prepared for that level of material, they experienced greater success and they went on to take the next math course in the sequence that next semester.

In addition to the placement tests administered by institutions of higher education, student advisors can do their part assisting students in making the right choice for the way in which they take a developmental math course. In administering the Motivated Strategies for Learning Questionnaire (MSLQ) to developmental students, certain characteristics were more prevalent in the developmental population than in those taking regular college courses or honors courses. Moore (2007) found that “developmental education students scored lower than honors and regularly-admitted students on items that measured learner beliefs, self efficacy, time management, and effort regulation” (p. 52). This suggests that developmental students tend to have a warped sense of how to be successful in learning, did not believe in themselves as learners, and had a difficult time properly managing their time. Upon learning this, Moore (2007) suggested that this could be an important tool to give along with a placement test to determine which academic supports would be helpful to that particular student. He also states that “instructors and advisors in developmental education programs should tell students which motivational traits are associated with academic success, and encourage these traits in students” (Moore, 2007, p. 54).

The diversion created when students were required to take developmental courses was identified as the “cooling out” thesis according to Clark (1960). In cooling out, marginally literate students who want to be in college but do not know why are shunted to the trades programs (Clark, 1960). Nearly 30 years later, Brint and Karabel (1989) added to the definition of “cooling out” by seeing “community colleges as one means by which

student ambitions were softly lowered to fit with the opportunities actually available in the labor market” (p.17).

Fischer (2006) suggests an additional, yet similar phenomenon where students are caught in what she calls the “basic skills gauntlet”. Inside this metaphorical gauntlet, “many students appear to become mired in these remedial courses without ever making it to for-credit course work” (Fischer, 2006, p.5). Because of this same gauntlet, students are discouraged from earning a community college degree or going on to a four-year university (Fischer, 2006).

Many controversies exist within the community colleges that pertain to the entire construct of developmental education. As reported by Vaughan (2005), “remedial education feeds into the process college administrators use to maintain access when enrollments exceed funds available to support them” (p.2). In other words, many institutions are taking advantage of the fact that developmental education is rather inexpensive to deliver, so students enrolled in developmental education are a source of revenue for the institutions, “despite budget cuts and inadequate revenue” (Vaughan, 2005, p.2). In defense of this accusation, one community-college president, in defense of the institution, states that “we didn’t enroll more students in remedial courses to make money. We did it to serve more students, to grow, and to make enrollment projections because that is what community college administrators are taught they are supposed to do” (Vaughan, 2005, p.3). This argument demonstrates one of the many debates over developmental education at the two-year level.

Vaughan (2005) further states that community colleges “offer remedial courses at levels below what an institution of higher education should be concerned with” (p.3). He

also retorts that an institution defining itself as an institution of higher education should not offer arithmetic, reading and writing at the fifth or sixth grade level (p.3). Cohen and Brawer (2008) further allude to this issue in saying that “the overriding issue is whether community colleges can maintain their credibility as institutions of higher education even while they enroll the increasingly less well-prepared students” (p.274).

The above authors are not the only individuals to question developmental education’s place in higher education. Cloud (2002) reports that “taxpayers spend approximately \$1 billion a year on the [developmental] classes” and because the taxpayers are already funding K-12 education, some argue that “we pay twice to teach some people the rudiments” (p. 60). Considering that many students have to take these classes “three, four, five times before they can pass them, and many drop out and give up before they do”, it may be that taxpayers are not only paying once in high school, but another 2-5 times in higher education for a student who might ultimately end up dropping out before successfully earn the credits (Blum, 2007, p. 62).

In response to this, many four-year institutions of higher education are eliminating developmental courses from their curriculum altogether. “In 1999 New York Republicans successfully pushed the City University of New York to curtail what had become vast remedial programs”, diverting students needing these courses to the community colleges (Cloud, 2002, p. 60). Since then, more than eight states have followed suit and some have even implemented their own rules for developmental education. Tennessee implemented a drastic policy in “banning the use of state money for any remediation, even at the community colleges” (Cloud, 2002, p. 60). Although California has not eliminated developmental classes altogether, students at the state colleges and universities have one

year to get through their developmental courses. If they do not complete the courses during this time period, they may not re-enroll and are told to take the classes they need elsewhere (Cloud, 2002).

In arguing for the support of developmental education at four year institutions, Lorenzetti (2005) calls the argument “simplistic at best” (p. 4). While politicians and other individuals and groups are claiming that developmental education is simply replicating what is offered in high schools, she found that “developmental education targets at least three distinct populations, each with their own needs” (Lorenzetti, 2005, p. 4).

“First is the true remedial population, those students who attempted but did not succeed at such basic subjects as reading, writing, and algebra. Second is the student who did not prepare for college. This student may be able to easily navigate the demands of college-level reading, writing, or mathematics, but he or she did not complete adequate preparation in high school. Finally, developmental classes serve the adult student. There is little as exciting as working with the stay-at-home mom who has decided to return to school to become a nurse, or the factory shift supervisor who needs an associate’s degree to earn that next promotion, but these students may have seen many years pass since they opened an algebra book or wrote a composition” (Lorenzetti, 2005. p. 4).

Therefore, those students who simply do not understand or failed to pay attention in high school are not the only learners who are in need of developmental education courses. Further research suggests that the “situation is particularly troubling for minority and immigrant students, as well as those whose families are low on the socioeconomic ladder” (Kirst, 1998, p. 76). Individuals need remediation for a variety of reasons and those in charge of making these decisions need to be mindful of all of the aforementioned factors and those who stand to be at a disadvantage in developmental education. Furthermore, “It is unreasonable to expect that any major changes in the preparation of high school graduates or the educational needs of adult learners will be substantial enough in the

coming decades to allow community colleges to get out of the business of developmental education” (Boylan, Bonham & White, 1999, p. 97).

In exploring the options beyond offering this remedial assistance to students, McClenney (2000) urges leaders to resist joining the “blame game” and cites the grim alternative to the community and general public. He writes that “we can pay the welfare costs, the costs of prison construction and the \$20,000 to \$30,000 that is required every year to jail one person, or we can invest in the lives of people we need for a healthy economy over the long run.” (p. 4). This is without mentioning the countless other government-supported programs that successful college graduates do not need.

A great deal of research is being focused on the alignment of K-12 objectives and standards and how they pertain to the expectations of colleges. According to Sanoff (2006), college professors are more deeply concerned about the abilities of college freshmen than their K-12 counterparts. “Asked about students’ overall preparation for college, 84 percent of faculty members – compared with 65 percent of teachers – say that high-school graduates are either unprepared or are only somewhat well prepared to pursue a college degree” (Sanoff, 2006, p.1). Reed and Conklin (2005) suggest that colleges need to establish “meaningful collaborations with the public schools” and to “create a direct link between a state’s college-readiness standards and its elementary and secondary school curricular standards” (p.2). Furthermore, many high school seniors “see the ‘second chance’ of two year college as making high school effort less relevant” (Rosenbaum, 1999, p.1). “If students realized that high school achievement is the first ‘experiment’ with strong predictive power, then students with poor grades would either revise their plans down, or they would spend more than 12 minutes a day doing homework: (Rosenbaum,

1999, p.3). Our system of education as a whole needs to stress the importance of all levels of schooling and how one experience builds upon the next.

If assessment of developmental education is to be the key component for sustaining the practice, an attempt must be made at community colleges to develop a way to judge the effectiveness of the program. In developing this assessment, Ott (2003) notes that, “we are not machinists attempting to calibrate exceedingly fine tolerances, and learning does not happen with tool and die precision. Nevertheless, we do have within our control the ability, using professional agreement, to define and document success, as well as the ability to define success along a continuum rather than an absolute value...” (Ott, 2003, p.1). Administration and faculty need to work together to develop a set method in which to assess the learning of students; thereby assessing the effectiveness of developmental education as a whole. Once decided upon, assessment can further help administrators and faculty members to realize the “reasons for effectiveness and ineffectiveness – and then to improve them” (Grubb, 2001, p.1).

If community colleges are forced to carry out assessment of developmental programs, how might institutions go about measuring these results? Ott (2003) suggests that a few constructs need to be in place for sound assessment to be carried out. Ott further states that clear agreements must be made on definitions of success and what in specific is being measured. He adds that community colleges must differentiate between faculty evaluation and student assessment, as they measure two different successes or perceived successes. Ott (2003) concludes that “our responsibility, I would argue, to both our students and the public, is to show clearly the extent of that improvement from level to level within our development program” (p.3). Community colleges certainly need to invest time in developing assessment

practices, but it is worthy to note that so many institutions have talked about this move toward assessment and accountability, but have never succeeded in devising an effective program and implementing it at the institutional level.

Armev and Pappas (2005) note that a push for more accountability needs to take place within the practice of developmental education in order to justify its cost and proven benefits to taxpayers. For example, the state of Washington experienced a 15.4 percent tax hike in the year of 2004 due to higher education costs. Included in these costs was the growth of developmental education. They further report that “voters were being asked to fork over a billion dollars a year to allow fund recipients to develop and meet key performance benchmarks” and that “they might have been more sympathetic if such benchmarks had already been developed” (Armev & Pappas, 2005, p.2). Is it prudent for community colleges to enact assessment in order to prove effectiveness to more than taxpayers? Although community colleges are currently not bound to one united form of assessment, research needs to be conducted in order to reveal best practices in assessment and to point these institutions in the right direction.

Grubb (2001) recommends “a variety of evaluation approaches that can improve information about many different aspects of remediation, including its effects but also the instructional methods used, the progress of students, and the ways students are assigned to remedial programs” (p.1). He suggests that this practice may “reveal the problems with existing programs including the potential reasons for their effectiveness or ineffectiveness – and then to improve them” (p.1). Furthermore, Grubb states that evaluation should be conducted on at least two levels. “One is the program level, where information about a particular course and a specific instructor” and the other to “include formal evaluations

carried out at the institutional level or the state or national level” (Grubb, 2001, p.3). With carrying out assessment on different levels, Grubb believes that the results of developmental programs can be both individually analyzed and compared to other programs state or nation-wide.

As the result of a meeting that took place in August of 2000, the American Association of Community Colleges’ Board of Directors replaced its Policy Statement on Developmental Education Programs (initially created in November 1987) to include future implications for successful programs across the country (AACC, 2000, p.1). Taken from policies and practices of documented successful programs, the Board constructed these guidelines to include that colleges must “Identify remedial education as an essential component of the institution’s mission; endorse, explain, and document the need for remedial education programs at the college and in the larger community...” (AACC, 2000, p.2). In extrapolating one small piece of this very first recommendation, the AACC is asking community colleges to document the need for remedial education. Further listed in the recommendations, AACC suggests that community colleges “evaluate remedial education courses and programs regularly to assess student performance, evaluate student performance in follow-up courses, and compare graduation rates of students requiring remediation in one or more skills with those who did not” (p.3). This push for assessment of programs is linked with program success. Although many other recommendations were outlined, the aforementioned were the most associated with the push for assessment of developmental programs as a future implication. Again, the need for tracking and assessment of students has been suggested as in the past.

If any community college is going to be successful in doing this, some person or group of persons need to take the initiative. In looking toward the future of developmental education, Cohen and Brawer (2008) report that “the community colleges are experiencing a metamorphosis similar in this regard to that which affected the compulsory sector earlier as state-level testing, curriculum standards, and graduation requirements gained prominence” (pp.424-435). In viewing the act of outside financing of community college programs, they “will be asked incessantly to provide evidence of increased productivity and specific programmatic outcomes” (Cohen & Brawer, 1996, p.431). Therefore, in order to satisfy mandates that may affect the sheer existence of the institution and some financial aspects, community colleges will have to devise a successful method of assessment in order to show these numbers to outside sources.

Apart from reporting to state and federal sources, Field (2006) suggests that “with college costs on the rise, institutions will come under increasing pressure to prove their worth to taxpayers and students’ parents, and many colleges will turn to testing” (p.1). One nationally known investor formerly on the Texas Board of Regents says “he believes colleges owe it to the people who invest in them to be sure they are using the money effectively” (Field, 2006, p.2). In the near future, it is quite possible for the commission, created by the Secretary of Education Margaret Spellings, “to place more emphasis on measuring the effects colleges have on students, or ask the Education Department to require accreditors to do so” (Field, 2006, p.3). Although this emphasis may result in more expectations for the college as a whole, measuring the effects colleges have on students may become a helpful way to assess the progress of students in developmental education and yield numbers in order to satisfy the external forces.

Still others posit that the future success of the community college will depend on greater communication of standards and expectations between K-12 education and the community college. Although “several states have made progress in aligning their high-school curricula with college standards and in better preparing their students for the demands of college”, not all states are following this trend (Wasley, 2006, p.1). When assigning a number to the “some” mentioned above, this “some” is translated into 13 states – 13 states out of the 49 with community colleges. Wasley (2006) further shares that “academic standards have been developed by elementary and secondary school educators largely in a vacuum and have traditionally not been anchored in real-world expectations of college and the workplace.” (p.1). The lack of communication is a problem needing attention. If our K-12 system is slowly turning into K-16, teachers at all levels need to communicate with one another in order to make this transition for students run smoothly. If high school students were to learn what colleges expect, they may take high school more seriously knowing that they need to learn the information presented in order to build on this information in college.

Further listed within AACC’s Policy Statement on Developmental Education Programs is one further recommendation regarding developmental education. AACC suggests that, based on current successful practices, community colleges should “foster collaborations with other educational agencies in the community; among college, middle school, and high school instructors regarding requirements for success in college-level courses” (AACC, 2000, p.3). Developmental education departments are also urged to “collaborate with teacher training programs at four-year colleges and universities to inform future faculty about critical remedial education issues, effective teaching and learning

strategies for unprepared or under-prepared students, and appropriate evaluation criteria for assessing quality of the remedial education courses and programs.” (AACC, 2000, p.3). If teachers-in-training were to learn about the wide-spread usage of developmental education, some may be inspired to create more supports for students in high school and middle school, be able to share this information with their potential students, and possibly take more ownership of the situation.

Bueschel and Venezia (2006) acknowledge the “differences in expectations at the high school and community college levels”, but also share initiatives being taken by community colleges and statewide systems around the country in order to link the standards from high school to the community college (p. 30). The authors further suggest that the concentration should be on state-level leadership and policy direction, adoption of standards by public postsecondary and K-12 education systems, and an emphasis on placement [not admissions] policies and standards. As further suggested, core skills must be defined for such a program, state high school assessments should mirror college placement tests and college readiness standards should be focused on from grades 8-12 (Bueschel and Venezia, 2006, p. 31). The idea of setting certain standards between K-12 and the community college should not be focused on as a negative system of accountability. Rather, it may be the only way to change the current practice of remediating the majority of all students entering the community college.

Another example of how K-12 and the community college can work together has been demonstrated through a program entitled *The Education Collaborative* taking place in Nevada between high school teachers and faculty of the local community colleges (Jacobsen, 2006). Aside from public service announcements geared at high school

students, encouraging them to take higher level math and English courses in high school, the school's math coach meets regularly with the chairman of the community college math department (Jacobsen). Within these meetings, the two educators discuss new ways in which to raise math awareness and how to make high school level courses transition into the college level work (Jacobsen, 2006). The two have also collaborated in designing a website for high school students. "The site lets students take practice placement tests to see what math courses they would be qualified to take in college" as well as offers various facts and games having to do with math (Jacobsen, 2006, p.3). This is an excellent example of how K-12 and higher education should meet and collaborate. Far too often, K-12 teachers are blaming college faculty and college faculty are blaming K-12 teachers for the growing number of students in need of developmental education. The aforementioned example shows how educators can put their energy into helping students transition from high school to institutions of higher education.

Another report concerning a state's effort to better prepare students for college-level work revealed higher standards for high school students in the state of Idaho. "High school students in Idaho will have to take more math and science courses under a plan approved by the State Board of Education. Beginning with the high school class of 2012, graduates will have to take three years each of math and science, and complete a yearlong senior project" (Fischer & Hebel, 2005, p.1). The State Board of Education has made this decision in striving to make students more prepared for the work force, as well as cut the near \$2 million cost annually on remedial education (Fischer & Hebel, 2005). Although this seems like a noble effort on the surface, if Idaho was truly dedicated to helping its students succeed, they would mandate four years of math and four years of science. While

this may not be true in Idaho, this particular state and every other state in the nation needs to motivate students with the want and need to learn.

If colleges are going to be held more responsible for reporting student success, then these colleges first need to find a way to aid students in being successful. In response to this, many institutions are trying varying means to increase student success, achievement and persistence.

The Community College and Addressing Developmental Math Issues

Developmental math has long been an area of need at the community college. In order to address this need throughout history, many different supports or constructs have been put in place in the hopes of increasing student success and achievement. Some of these supports have been found to be successful, while others have not. In addition to this, the limitations to many of the supports and constructs in the literature do not generalize well into the greater population of diverse students taking courses in developmental math.

Many institutions have documented the success of mentoring on student success. In response to a student survey citing a “perceived lack of academic and personal support”, the University of Detroit Mercy created a professional mentor program. This program included “(a) mentor/mentee pairing based on academic interest/need; (b) required professional development workshops coaching students in the means to “independently work through their academic interest/need; and (c) an intergenerational outreach component, whereby both mentors and mentees participated in a mentoring experience through a partnership with a local middle school.” (Scott & Homant, 2007, p. 63). After implementing this mentoring program, the institution reported that “feedback from

participants was overwhelmingly positive, and a small but statistically significant increase in GPA was reported” (Scott & Homant, 2007, p. 72).

While some institutions have chosen to supplement developmental math with an ancillary program to aid in student success and achievement, others have chosen to vary the way that the course itself is delivered. In response to the low pass rate for developmental math courses, Montgomery County Community College, located in Blue Bell, Pennsylvania, has implemented an entirely new course. As some students expressed their frustration with the pace of the course during a focus group session, one instructor created a course that “condenses two semesters of classes into one, and offers a medium-paced course that focuses on algebra but includes some review of arithmetic when needed” (Blum, 2007, p. 62). Montgomery County Community College offers two levels of developmental math courses with two different areas of content – the lowest basic arithmetic and the higher college algebra. This newly piloted course will eliminate one level of remediation, while being flexible with the amount of time students need to master the material.

Yet another strategy recently offered at Montgomery County Community College is their two-week refresher course. Blum (2007) writes that “the courses were intended to give students taking arithmetic in the fall a leg up, and to allow others who had scored relatively high on the placement test to skip basic math and move right into beginning algebra” (p. 62). Therefore, students can choose to attend this course to increase their odds of being successful, or even skipping one level of remediation altogether.

In these times of technological advance, some institutions are choosing to pair their developmental math courses with interactive math software. Trenholm (2006) observes

that “in the business and academic communities, there is an increasing recognition that the ‘chalk’ and ‘talk’ didactic lecture is limited in its ability to effectively deliver instruction” and that our current generation of technologically savvy ‘millennials’ need to be reached (p. 53). In response to this, at least one institution of higher education is replacing the traditional classroom delivery with interactive-multimedia-mathematics software. In response to frustration experienced by administration at California State University in that a disproportionately large percentage of students entering the university were un-prepared and/or under-prepared for math, Cal State offered a number of developmental math sections taken strictly online. They found that “the students who had previously completed an interactive online course in intermediate algebra course earned 49 percent more A’s, B’s, or C’s in pre-calculus than did the students who completed an algebra course in a traditional classroom” (Olsen, 2000, p. A57). One instructor at the university states, “not only have our pass rates gone up, but we also feel that our students are doing at least as well, and probably better, in their university-level courses” (Olsen, 2000, p. A57). Publishers and other companies see the developmental education arena as a “lure for business” and will continue creating and “promoting products and services built around the internet” (Blumenstyk, 2006, p. B30).

One multi-campus community college in the Southwest is piloting yet another program to promote developmental student persistence and retention. At this institution, “Student Retention Specialists were hired to target under-prepared students, follow up with their cohorts, and experiment with a variety of interventions” (Escobedo, 2007, p. 13). These other interventions included orientation sessions, classroom presentations by the Student Retention Specialist, frequent contact with the students, participation in learning

communities and student success classes. The results at the end of this three year pilot show that “those students who received at least one contact with the Student Retention Specialist persisted to their second semester at higher rates than the general population [and] this was regardless of ethnicity” (Escobedo, 2007, p. 14). The author concludes that “‘high touch’ effectively contributed to retaining students” (p. 16). The more contact these Student Retention Specialists had with their assigned developmental student, the more likely the institution was to retain that student into their second semester.

Another support suggested for developmental math students is structured note-taking. According to Eades and Moore (2007), “students [frequently] consider textbook examples a ready-made source of math notes. Some may believe it more important to devote full attention to watching the instructor work problems on the board, rather than also systematically recording them on paper” (p. 18). They also note that students engage in “cognitive dumping”, which is “compartmentalizing learning so that when a new chapter, section, or topic appears on the horizon, previous skill building and training is stored away or discarded to make room for what comes next” (Eades & Moore, 2007, p. 19). It is suggested that instructors highlight the importance of taking well-structured notes and actually teach the class how to take useful notes in math, as “reading or studying notes in one’s own handwriting may lead to much better recall and retention, whereas merely studying examples from a textbook may be more impersonal and detached” (Eades & Moore, 2007, p. 19).

Many community colleges are also providing more flexibility to their developmental students. In presenting data derived from a national study, the American Association of Community Colleges reports that nearly half of responding institutions are

offering alternatives insofar as the course is delivered. “Nearly half of institutions offered self-paced courses to their students [and] approximately one quarter of the responding institutions offered remedial courses through distance education” (Shults, p. 9).

Supplemental Instruction

In seeing a need for extended support for struggling students, Deanna C. Martin, at the University of Missouri-Kansas City created Supplemental Instruction. Supplemental Instruction is a “model of student academic assistance [that] helps students in historically difficult classes master content while they develop and integrate learning and study strategies” (Arendale, 2001, p.2). The Supplemental Instruction model is also sometimes used in classes that are considered “gatekeeper” classes and large-group lecture format classes. There is no limit to the type of class that Supplemental Instruction can be used in, as the format allows for use across disciplines.

The four key persons involved in Supplemental Instruction are the SI Coordinator, the faculty member/professor, the SI Leader and the participating students (Arendale, 2001). The SI Coordinator is in charge of finding historically difficult classes that are being taught by welcoming faculty members to attach to SI sessions. In addition to this, the SI Coordinator hires the SI leaders, provides training for SI leaders, does session observations and evaluates the program. The faculty member is the individual teaching the class for which a SI session has been attached. The faculty member communicates with the SI leader and reminds students of the availability and importance of the SI sessions during class meetings. The SI leader is in charge of facilitating the SI session. She or he is a peer (fellow student) who has taken the class and has been successful in the class. The SI leader acts as a model student by attending all class meetings, taking notes, participating in class

and doing all assigned homework. During the SI session, the SI leader acts as a facilitator and uses a combination of content from the current class and study skills and success strategies to set the stage for students teaching and learning from one another. The students are those enrolled in the class and are attending the SI sessions offered (Arendale, 2001).

The three main goals of SI are to improve student course grades, reduce the attrition rates in historically difficult college courses, and to aid students in persistence toward graduation (Arendale, 2001, p.3). In addition to this, since SI sessions are a combination of process and content facilitated by the SI leader and class information is not simply re-taught, another goal of SI is to teach students how to learn. “SI accomplishes these purposes by using the process of cooperative/collaborative learning to integrate instruction in learning and reasoning skills with a review of the course content of selected courses” (Arendale, 2001, p.3).

To identify courses that would benefit from an attached SI section, the SI coordinator speaks to administrators, faculty, and students and looks at data to determine which courses being offered are considered to be historically difficult courses. The SI definition of “historically difficult” applies when greater than 30% of students in a class fail to succeed by earning a D or F or withdrawing from the class altogether. If the faculty member teaching the historically difficult class is receptive to SI, a section is created and a SI leader that compliments the faculty member is chosen.

SI targets difficult courses – not high-risk students (Arendale, 2001). Therefore, students do not see their attendance at the sessions as remedial. In addition to this, SI sessions are decided at the beginning of the semester, so they are going on throughout the entire semester and not only when a student is having particular difficulties. It is also

strongly suggested that SI avoids being viewed as compensatory and that students should not receive any extra credit for attending SI – their reward is increased academic performance (Arendale, 2001). This voluntary approach to SI and outlook on student rewards also acts to build students' intrinsic motivation, thus further helping students become self-learners and motivators.

A great deal of research has shown that Supplemental Instruction is, in fact, successful in addressing the three primary goals as well as fostering student achievement in other areas. According to a national data compilation of 270 institutions collected by the University of Missouri-Kansas City, “In comparison with their non-SI counterparts, SI participants received a higher final mean course grade, higher percentage of A and B final course grades, and a lower percentage of D and F final course grades and withdrawals” (Arendale, 2001, p. 22). Arendale goes on to state that these data are consistent with the data collected solely from the University of Missouri-Kansas City. Student grades are not the only area benefiting from the use of Supplemental Instruction.

In a study conducted at the University of Georgia, “Supplemental Instruction was shown...to have both short-and long-term impact on conditionally accepted students. Conditional students receiving SI scored significantly higher, in comparison with the conditional non-SI group.” (p. 6). In this same study, “Reenrollment data indicated that conditional SI participants reenrolled at a higher rate than that of any of the other three student groups” (Ogden, Thompson, Russell & Simons, 2003, p. 6). Similarly, as observed at the University of Missouri-Kansas city, this different set of data “suggests that SI makes a positive difference in terms of increased reenrollment” (Arendale, 2001, p. 19).

Not only are student grades shown to be higher and reenrollment and student persistence increased, but graduation rates are similarly affected. Bowles, McCoy and Bates (2008), found that “SI attendance in freshmen level courses has a statistically significant influence on graduation success (and) indeed, SI attendance...increases the probability of timely graduation by approximately 11%” (p. 5). Not only are graduation rates found to be higher among this group of SI participants – one major goal of SI, but, more specifically, timely graduation is occurring in many cases. The University of Missouri-Kansas City study also reports that “SI makes a positive difference in terms of increased college graduation” (Arendale, 2001, p. 21). “When students attend SI regularly, they learn the material more effectively and their grades improve. When students learn more, they tend to stay in the discipline of their choice, reenroll, and persist to graduation” (Zerger, Clark-Unite & Smith, 2006, p. 65).

If Supplemental Instruction is offered only for one or a few historically difficult courses that a student might encounter in his or her college career, why is it given credit for student reenrollment, student persistence, increased student grades and increased graduation rates across the board? Researchers at The University of Georgia state that, “It may also be argued that the skills and learning strategies practiced in SI sessions by conditional participants generalized to other courses taken during the SI treatment quarter as seen by higher Fall Quarter GPAs in comparison with conditional non-SI counterparts.” (Ogden, Thompson, Russell & Simons, 2003, p. 6). In light of this observation, not only are students doing better insofar as quantitative results are concerned, but are also learning how to learn and apply SI strategies to their other courses.

Thus far, the literature has suggested that Supplemental Instruction is effective in raising student grades, increasing student persistence and student graduation. Students also express positive opinions about Supplemental Instruction. When asked a series of questions on a mid-semester and end of semester evaluation, student responses were “overwhelmingly positive” (Stone, Jacobs & Hayes, 2000, p. 134). “Of the 52% of students who reported having attended SI, 92% indicated that they found SI to be helpful” (Stone, Jacobs & Hayes, 2000, p. 134). More specifically, students reported enjoying the organization of the course material, the reinforcement of major concepts in SI sessions, question clarification and comfort in asking questions during the SI session, the identification of key content, the ability to learn in a “safe” environment, the opportunity to voice understanding, the exposure to other interpretations, and a deeper understanding and increased confidence (Stone, Jacobs & Hayes, 2000, pp. 134-135). In responding to enjoying the “safe environment” of the SI session, one student writes:

“I like how we all figure out and understand the material together. I don’t feel pressured to already know things, or feel expected to understand everything. It’s very comfortable and personable. I feel like I get the attention I need to learn things” (Stone, Jacobs & Hayes, 2000, p. 134)

In commenting on the evaluation question concerning the leader’s role, another student shares that:

“The SI leader takes a lot of time to prepare us and help us reach our goals. You walk out with more than you came in with because of effort from yourself, the group, and the leader. You check your interpretation of the material with what the other students think and you see if they have important information you might have missed” (Stone, Jacobs & Hayes, 2000, p. 135).

The students are not the only ones to benefit from the implementation of Supplemental Instruction. The research suggests that Supplemental Instruction leaders also

benefit from conducting the sessions. At a study done at LaGuardia Community College, it was found that ninety-five percent of respondents reported that SI was very helpful in giving them a better understanding of the course material; seventy-three percent reported that their work as SI leaders helped them choose a career; and ninety-eight percent reported that being an SI leader helped them gain self-confidence and gave them an opportunity to strengthen their leadership and communication skills (Zaritsky, Ship, & Toce, 2006, p. 28). In viewing the responses given by SI leaders at St. Xavier University as they expressed the meaning of the SI experience, students reported positive outcomes such as an appreciation of diversity of student learning needs, enriching academic experiences, enriching interpersonal experiences and a more positive relationship with faculty (Lockie & Van Lanen, 2008, p. 8). In addition to this, the SI leaders, “benefit because their own learning improves when they structure learning experiences for the students they are guiding” (Lockie & Van Lanen, 2008, p. 10). SI leaders have also cited better personal study strategies as a benefit. In response to an evaluation question, one SI leader states, “I have learned how to study effectively within a group. I also know that the best way to learn something is to teach it to someone else” (Stone, Jacobs & Hayes, 2000, p. 134).

Apart from benefiting the student population at an institution of higher education, faculty members can also benefit from the implementation of Supplemental Instruction. SI can be seen as a type of informal faculty development. In working closely with the Supplemental Instruction leaders, faculty members are coaxed out of their “silos” and encouraged to collaborate with the leaders and other faculty members (Zerger, Clark-Unite & Smith, 2006, pp. 64-65). SI leaders can also act as the messenger between students and faculty members to share student struggles, perceptions and constructive feedback as,

“faculty appreciate feedback from leaders on the questions and difficulties students are having” (Zerger, Clark-Unite & Smith, 2006, p. 65). Formal faculty development can also result from the Supplemental Instruction program through the inclusion of faculty members in SI training workshops and meetings. “These trainings help faculty learn new pedagogy, understand active learning and collaboration, and produce good ambassadors on campus for SI (Zerger, Clark-Unite & Smith, 2006, p. 65). Faculty members are not the only entities at the institution to benefit.

The benefits of SI extend beyond the classroom and SI session room to affect administration and the institution. Zerger, Clark-Unite and Smith (2006) state that “administrators and institutions benefit when students learn and when budgets are balanced [and that] SI contributes to both goals” (p. 66). Because SI is not a one-on-one situation, more students are being reached with one SI leader (and one SI leader stipend). Since participating in SI can be seen as both a formal and informal faculty development experience, the institution is saving money that would otherwise have to be spent on these meaningful faculty development experiences.

Supplemental Instruction does not have to be confined to the classroom and SI session room. Other offices and programs can become involved in the SI program at any given institution. For example, “Teaching-learning centers could become even more helpful by providing workshops or additional resources on the SI strategies that have been proven to increase student retention and understanding” (Painter, Bailey, Gilbert & Prior, 2006, p. 73). Campuses utilizing the learning communities approach to teaching and learning could integrate the two, since they both operate by similar premises. “Because Supplemental Instruction was designed to give students the opportunity to interact as they

construct knowledge, SI and learning communities would seem to be a natural partnership” (Painter, Bailey, Gilbert & Prior, 2006, p. 75). The same authors further suggest the integration of Supplemental Instruction and online learning communities. “Having peer educators trained as SI leaders, and having the instructors trained on the SI model, would only serve to enhance the online learning community” (Painter, Bailey, Gilbert & Prior, 2006). In response to each institution’s unique needs, programs, students and faculty members, many additional partnerships could be created on campus with Supplemental Instruction.

Although there is one “pure” model or prescription for SI, many institutions choose to apply some variations to suit programming and student needs. Also borne out of the University of Missouri-Kansas City, Video-based Supplemental Instruction (VSI) is one example of these variations. In an effort to target and retain those students who “fell at or near the bottom of the fourth quartile”, and “for whom SI offers insufficient support”, students enrolled in these courses watch a professor’s course on video tape, as opposed to attending the regular class session (Arendale & McLaren, 1999, p. 45). “VSI students, led by a trained facilitator, start and stop the videotaped presentation at pre-determined times and, in addition, whenever they have a question or want clarification” (Arendale & McLaren, 1999). Because of the ability to do so, students can absorb the information at their pace, rather than having to be rushed through the traditional course where material is mentioned and class goes on. The SI leader in these sessions operates similar to the SI leader in traditional SI sessions, but encourages students to ask questions and checks for clarification during the professor’s lecture. VSI grade results are also similar in that

“students on average earn grades that exceed those of the regular campus lecture section” (Arendale & McLaren, 1999).

At one state university in the southwest, the SI coordinator, SI leader and faculty members were having difficulties with the standard implementation of SI for a developmental math class. After much deliberation among team members, modifications were made to include greater participation of and additional responsibilities for the SI leader during class sessions. This particular modification resulted in the observation that “many students in the two sections developed a better attitude about the course and mathematics in general” (Wright, Wright & Lamb, 2002, p. 32). Although affective in nature, students took a different approach to thinking about math, which is a positive start.

At a different university in the southwest, the SI coordinator was in need of a modification for SI in order to increase student attendance. After this attendance issue was identified, “the learning specialist of a federally funded program developed an intervention for at-risk incoming freshmen that she believed would strengthen their prerequisite skills and confidence” (Stansbury, 2001, p. 4). In addition to offering SI for this particular class with low student motivation, Accelerated Learning Groups (ALGs) were created and offered simultaneously. Paired with the content and skills in SI, the tutor for the ALG developed an Instructional Education Plan (IEP) for each student attending and paired him or her with two other students with similar entry skills (Stansbury, 2001). Positive results were suggested in that “participating in an ALG/SI combination may be related to increased SI attendance and increased final performance for at-risk students” (Stansbury, 2001, p. 5).

Another possible strategy for increasing student attendance and participation might be to make SI attendance mandatory. Although it is strongly suggested by those involved in the creation of SI that SI avoids being viewed as compulsory, others suggest that it may increase student grades and performance (Arendale, 2001). After finding that ALGs in addition to SI did not make a difference in student attendance in SI, Stansbury (2001) wrote that “based on the finding that a high percentage of high-risk students failed to attend SI voluntarily...further research on the effects of mandatory, rather than voluntary, attendance of high risk students in SI could prove beneficial to developmental educators as well” (pp. 9-10). The act of making Supplemental Instruction attendance mandatory for students who are considered “high risk” is the subject of this present study.

On mid-semester and end-of-semester course evaluations consisting of open-ended questions, students cite a variety of reasons for not attending SI sessions. Almost half of students in this particular study, “predominately cited scheduling conflicts with work, school, and family as their reason for not taking advantage of the program” (Stone, Jacobs & Hayes, 2000, p. 134). Over one quarter of students provided responses that suggested “that SI was perceived as unnecessary: they were doing well in the course, the class was too easy, they already had a study group, or they were not motivated to do well in the class” (Stone, Jacobs & Hayes). Those left who were not attending SI sessions gave other reasons to include that “students preferred to study alone, or with a tutor; they did not enjoy SI sessions because of the conduct of other attendees; or that they had heard SI was not helpful, so they did not bother to attend” (Stone, Jacobs & Hayes). Further research cites that “many students are reluctant to attend the sessions on a regular basis, opting to attend

only before an examination or a quiz” (McGuire & Yancy, 2006, p. 9). That being said, attendance is one challenge faced when implementing SI at the institution.

Other challenges do exist in the implementation of Supplemental Instruction. McGuire and Yancy (2006) suggest that increasing faculty buy-in for the SI program is not going to be an easy feat. If a faculty member is not actively embracing the SI program and coupling it and encouraging it with the regular class sessions, some students fail to see the importance. It is suggested that “institutions help faculty members understand the relationship between SI and student learning, and to disseminate information on how the SI program benefits the institution, the students, and the faculty” (McGuire & Yancy, 2006, p. 9). In addition to participation and faculty buy-in, institutions need to make SI attractive to the Net generation. “Many of today’s students appear to be much more interested in interacting with their computers (e-mailing or gaming), using their cell phones (talking or text-messaging), or playing games on their Xboxes than in interacting with one another to learn course content” (McGuire & Yancy). The authors stress the importance of reaching this generation by means of new approaches to “recruiting” for Supplemental Instruction.

Although a number of studies, some dating as far back as the 1970’s, have reported on the benefits and successes of using Supplemental Instruction with historically difficult college courses, few studies have included the alterations to the “pure” form of Supplemental Instruction currently being used at SCC. In the early attempts at creating a successful Supplemental Instruction program, it was decided, through a faculty-led initiative, that Supplemental Instruction would be piloted with developmental math, or their MAT 060 course (despite warnings against using Supplemental Instruction with developmental courses) and would be made mandatory. Certain sections of MAT 060

offered at SCC would automatically have a planned Mandatory Supplemental Instruction (MSI) component attached to the course. These planned sessions would occur directly before or after the MAT 060 class meeting and would be announced in the course catalog and online as an altogether separate meeting time in addition to the regularly scheduled class. Faculty advisors and counselors were made aware of this special class offering and were asked to encourage students with certain characteristics (repeating the course, coming from the lower level developmental math course or having received a particular placement test score) to register for these designated sections. The unique steps taken at SCC made the MSI program at SCC unique in its structure and offering.

CHAPTER 3

METHODS

Introduction

This research included all students enrolled in MAT 060 at Suburban Community College (SCC) during the fall 2009 semester. During this semester, MAT 060 was offered in three different formats – the traditional classroom three hour lecture format, the computer-based individualized format and the Mandatory Supplemental Instruction (MSI) combined with the traditional classroom instruction format. All groups were separated to determine and quantify the value added to the students who were participating in the MSI program, as well as to determine if certain groups especially benefited from this type of classroom support.

Research Design

When applying to Suburban Community College (SCC), all students, with the exception of those transferring in a college-level math course from an accredited institution, were required to take a math placement test to predict their success in and readiness for college math. SCC uses the Accuplacer Test, which is a College Board Adaptive Test. This computerized test starts with a series of 12 algebraic questions for the student to calculate and answer. Dependent on the student's score, the test either concluded and suggested that the student be placed into MAT-060, or continued on to lower-level arithmetic to gauge if additional help was needed at a lower math level. At this point, the exam may have placed a student into a lower section of developmental math (MAT-040). If the student did well with both algebra and arithmetic, the exam continued

on to additional problems that included college algebra and higher level math questions. At this point, the students' score determined if they have (1) placed into college-level math, (2) placed into arithmetic (Mat-040), or (3) placed into elementary algebra (Mat-060). On average, Suburban Community College offers **20** sections of elementary algebra each semester. See Table 3.1. Students who placed into arithmetic must also take elementary algebra before meeting the basic criterion for taking a college-level math course.

Table 3.1: Suburban Community College Math Placement Test Scores

<u>Accuplacer Mathematics</u>			<u>Course Placement</u>
<u>1st Score</u> A*	<u>2nd Score</u> EA**	<u>3rd Score</u> CLM***	
<25 and	<25		Minimum Entry (See Counselor)
00-66 25-66	25-39 00-39		Basic Math (MAT 040)
>=67 { }	<40 40-59		Dev Math (MAT 060) (Required if MAT 100, 110, 120, 130,140 or 160 is required in major) or Business Math (MATH 105) (Required in some career programs; <u>not</u> allowed in Lib. Arts or other transfer programs)
{ }	60-79		Intermediate Algebra (MAT 100) (Allowed in Liberal Arts as open elective) Technical Math (MAT 110), or Modern College Math I (MAT 120), or Modern College Math II (MAT 121), or Math for Elem. Teachers I (MAT 125), or Finite Math (MAT 130)

*Arithmetic

**Elementary Algebra

***College Level Math

The table above shows how students place in one of the above mentioned levels of math. Three different levels of math are tested on the Accuplacer Placement Test – Arithmetic, Elementary Algebra and College Level Math. If a student beings the test and performs poorly on the Elementary Algebra section of the test, the student is then presented with questions from the Arithmetic section (see test scores for 1st score and 2nd score in Table 3.1). If the student’s score is low on both Elementary Algebra and Arithmetic, the student is placed into MAT 040. If a student scores low on the Elementary Algebra section and does well in the Arithmetic section, he or she places into MAT 060. If the student does well in the Elementary Algebra section and then does well in the College Level Math section, he or she will place into College-Level Math.

Success in MAT 060 is important at SCC, as it acts as a “gate-keeper” course. If students are not able to successfully pass this course, their choices of classes to take during the next semester are greatly limited. The successful completion of MAT-060 is a pre-requisite for all college-level Math courses, some business courses and some science courses. MAT-060 is a pre-requisite to courses that need to be completed for entrance into certain programs such as Nursing or for Core to Core transfer, where students can fulfill all Core requirements for a specific program at the community college with a guaranteed transfer to a four-year institution. Even more importantly, the successful completion of MAT 060 is necessary for achieving an Associate’s Degree or for transferring to a four-year institution. Because of limited options and the fact that many students have to take MAT 060 at SCC multiple times, many students leave with few credits (if any) and an inability to earn an Associate’s Degree or transfer to a four-year institution.

Prior to the beginning of the fall 2008 semester, all students who placed into MAT 060 or lower were randomly assigned to one of two types of class formats. These were:

- (1) The conventional format where instruction is primarily through lectures.
- (2) The individualized format. In this type of class, all instruction is provided through a computer using Interact Math software, Digital Video Tutor and math methods videos chosen by the SCC mathematics department. Although the students meet as a group for a formal class “session” in the Math and Science Learning Lab, students work at their own pace and on their own objectives. The individual student objectives are identified for each student by a pre-test given at the start of each new chapter. At the end of each chapter, the students take a common test on the entire chapter to determine mastery of all objectives for that chapter.

Faculty members in the math department were assigned in such a manner that, to the extent possible, they taught both the conventional and the group format courses. Additionally, the two types of instructional format were scheduled so that both types were available at all times in the scheduling matrix (i.e., Monday-Wednesday; Tuesday-Thursday, Monday-Wednesday-Friday, evenings, weekends, etc). SCC has a math lab where peer tutors are available throughout the semester during both day and evening hours. The disadvantaged student ACT-101 learning lab also offers tutors to the developmental math population using professional tutors in a one-on-one setting. Students in both math formats are permitted to use the math lab at any time. The college also employs peer tutors and professional tutors that can be used by all students during various hours at all campuses of SCC.

Learning materials provided to students are the same in all sections of MAT 060. All students are required to purchase the same textbook that comes bundled with the same Interact Math online password. This textbook that is used for MAT-060 has been specially created to address the objectives for all MAT-060 courses at the college. In addition, SCC provides students with a Course Resource Guide Book that was constructed by SCC math professors. This guide compliments the progression of the textbook chapters and the departmental final exam.

At the end of each semester, students in both formats of MAT-060 will have earned one of four grades: High Pass (HP), Pass (P), Non-Pass (NP) or Withdrawal (W). Departmentally, a final average of 70% is needed in order to receive a P in the course. It is up to each instructor to determine whether he or she sees the student as deserving the grade of HP. Some instructors use 85%, while others designate a 90% as the cut-off grade. Despite a common final exam, instructors also have the freedom to weigh assignments, chapter tests, the final exam, attendance and participation as they see fit.

As part of the “Achieving the Dream” initiative, Suburban Community College has actively researched ways to aid students in succeeding at the community college level. At the start of this initiative, five teams were assembled to collect data on the college’s course outcomes, disaggregated by many different student characteristics. These data consisted of success rates and withdrawal rates associated with particular classes and led the teams to focus on specific courses and specific categories of students. After data collection, the teams gathered additional data on perceived barriers to student success by consulting faculty, surveying students and conducting student focus groups. Through this initiative at the college, developmental math has been targeted by the committee as an area needing

additional assistance and support to be made available to enhance student success and persistence.

As a result of the Achieving the Dream data collection and analysis, an additional format of developmental math was adopted as a pilot study. During the fall 2008 and spring 2009 semesters, developmental math was offered in an additional format pilot study for SCC using the conventional lecture format paired with Mandatory Supplemental Instruction. Students enrolled in the Mandatory Supplemental Instruction (MSI) format attended classroom lectures for three credit hours each week but were also given an additional mandatory hour of Supplemental Instruction that took place for one hour before or after the lecture two days a week. MSI sessions were facilitated by the MSI Leader and included activities such as group work on sample problems, study skills, test-taking strategies, how “to do college” and review for the cumulative final examination. Because the pilot study suggested that the MSI treatment was making a difference in student success, the college decided to continue with MSI as a full sized study.

Faculty members interested in being part of this MSI pilot program volunteered to attach MSI to their classes while other faculty members were asked if they would allow their section to be a part of the pilot program for campus location and scheduling reasons. The three MSI pilot sections were offered on two of the three of SCC’s campuses and were only offered during the day. These students also had access to the math lab and the ACT-101 Learning Center tutors.

During the pilot semester of MSI, data suggested that students in the MSI sections succeeded at a greater rate than their non-MSI counterparts. Due to the small sample size, statistical significance in favor of the MSI program was not achieved, but was determined

to be approaching significance. These results were achieved despite the fact that one of the three faculty members involved in this pilot did not iterate a mandatory attendance policy to students participating in her one section. The complete study on MSI at SCC is taking place.

Sample, Population or Subjects

The students enrolled in the MSI sections of developmental math at Suburban Community College are students who scored between 40 and 59 on the placement test upon applying to the college (refer to Table I) .

These students included in this study are diverse in ethnicity, gender, age, location and ability. Some students were taking courses at SCC immediately following high school, some had recently completed MAT-040, and others were returning back to school after having children and raising a family. Other students were coming to SCC after having to leave another institution for being on grade probation or because of family or money issues. Some students took MAT-060 for a second, third or even fourth time. All information used to compare the groups of students was retrieved electronically from data files on student applications upon entering the college. The specific student variables being examined were chosen because they were readily available through the college's database and could be derived and compared easily.

Before piloting MSI, it was "loosely" presented to faculty advisors and counselors that students who (1) were required to take MAT-040, (2) scored at the lower end of the placement test requirement for placing into MAT-060, or (3) were repeating MAT-060, or were the students to place in the MSI sections. Some faculty advisors used this information, while many did not. Therefore, most students did not know what to expect in

the MSI MAT-060 sections. Some students were told that the entire class lecture was five hours per week, while others were told that the SI component was optional and yet others were not told why they had an extra two hours blocked out of their schedule. Therefore, students were not given a uniform explanation of the MSI program when registering for the class.

Students placed in a MSI section for the following reasons:

- Counselor/Advisor recommendation due to repeating MAT 060
- Counselor/Advisor recommendation because the student had just completed MAT 040.
- The student was informed of the MSI program by the pilot study leader in an informal class presentation on the pilot data from past semesters.
- The student heard of the program and was encouraged by the success rate for those students involved and wanted a greater insurance of success in this course.
- The MSI section designated in the course catalog fit into the student's schedule better than any other MAT 060 courses offered.
- The student was given misleading information that the SI portion of the class was voluntary.
- The student was given misleading information by the counselor/advisor that the student could attend either session listed in the catalog, although one session was designated for classroom instruction and one session was designated for the MSI session.

- The student registered for the course online and failed to notice the additional sessions listed.

Instruments

This research design did not include a newly created instrument. The data used for this study were obtained from class grade records, MSI session attendance records, student entrance applications and formally written focus group notes. The first was achievement in the class as assessed by the students' final grade. Since this developmental math course was a "non-credit" course, final grades are given in the form of HP (high pass), P (pass), NP (non-pass) or W (withdrawal). The second type of data are the students' record of attendance and participation in MSI sessions.

Secondary sources of data included results from informal focus-group studies conducted with all MSI sections in the pilot, anecdotal records kept by the MSI Leader, student exam scores, and student demographics and characteristics as stated on their college application. Formal focus groups were conducted each semester with the pilot of MSI and were continued during this first formal delivery period. During these focus groups, a particular set of questions were asked to each group of students participating in the MSI program. Students are asked these questions by a designated questioner – an administrator who is not considered a stake-holder in the program – and student answers are recorded by a designated recorder. Answers were compiled and then grouped into categories for analysis. In addition to focus group results, all students participating in the MSI program were given a follow-up survey asking qualitative questions such as feelings about the program, experiences during the program and about their general experiences with MSI at SCC.

In addition to the aforementioned data collected, demographic and attitudinal variables were analyzed in an exploratory fashion in order to see if any of these factors have an effect on student success.

This study is based on two research questions.

(1) Does the inclusion of the mandatory supplemental instruction have a significant impact on student final grades?

This was answered by an analysis of variance using the final exam in the course as the dependent variable and course type as the independent variable.

(2) Can success in sections MAT 060 with Mandatory Supplemental Instruction be predicted from demographic and variables?

This was answered by a multiple regression with final grades as the criterion variable and demographic and attitudinal variables.

CHAPTER 4

RESULTS

This chapter includes a comprehensive report of this study which examined the impact of Mandatory Supplemental Instruction (MSI) on success rates of students enrolled in MAT 060, the developmental math course at Suburban Community College. The first section of this chapter contains a comparison of the students enrolled in the MSI sections to the students enrolled in the traditional classroom sections and individualized format sections. The second section presents the data relevant to the two research questions that underlie this study. The third section presents data relevant to a series of secondary questions that were created in response to the results from the major research questions. The final section of the chapter presents results from a follow-up survey given to all students in the MSI group, as well as results from a formal focus group conducted with students reporting student perceptions of the MSI program.

Demographic Data on the Subjects

Descriptive data on the subjects in the three versions of MAT 060 are presented in Table 4.1.

Table 4.1: Demographic Data on the Subjects

	All MAT 060	Traditional	MSI	Individualized
# of cases	1180	812	82	286
Average age (mean)	22.6	22.7	21.8	22.2
Percent female	54.1%	54.8%	53.1%	52.1%
Percent Black/African-American	18.6%	19.1%	17.5%	17.7%
Percent Graduated High School in 2009	38.9%	38.6%	51.2%	36.2%
Percent Graduated High School in 2007 or 2008	28.6%	28.2%	26.3%	30.1%
Percent of Students Enrolled on the Main campus	64.8%	56.5%	63.4%	88.8%
Percent of Students with Math test score of 40-45	35.5%	34.1%	34.1%	40.3%
Percent of Students Enrolled as Daytime	87.5%	87.4%	87.8%	87.8%

The three groups were compared using the variables listed in Table 4.1. These variables were taken directly from the SCC database. The only significant difference was in the percentage of students attending the Main Campus. The chi square computed equaled 96.76 ($p < .001$, effect size = .071). (Note: For all of the analyses that are significant, an effect size will be reported as an additional statistic. The specific version of effect size used in this dissertation is partial eta squared. In most of the current texts, a partial eta squared of .10 or greater is considered meaningful. This value corresponds to a Cohen's d of .7 which is between a medium and large effect size. Thus, in the analysis reported above, the chi square is statistically significant but does not quite reach the level where the result would

be considered meaningful.) It is evident from Table 4.1 that a significantly higher proportion of the students in the individualized group attended the Main Campus. This is the case because MAT 060 individualized math classes are overwhelmingly offered on the Main Campus for purposes of staffing and space. The only other campus that offers the individualized format is one small campus in the next county and this campus offers only one section of MAT 060 in the individualized format.

In viewing the characteristics of the sample of students in the MSI Group, as compared to the characteristics of those in both the traditional classroom format and individualized sections of MAT 060, it is evident that the three groups are similar in all ways that might affect the results. The difference in attendance on the main campus for the SI students is not considered a critical difference and should have no systematic effect on the results.

Results in Response to the Major Research Questions

The first major research question is: does the inclusion of the mandatory supplemental instruction have a significant impact on student final grades? This question is answered in two ways. First, the class types are compared on the dichotomous outcome of Success/Not Success. Second, the Not Success Students are divided into two groups: those who received the grade of NO PASS, and those who did not succeed for some other reason. The outcome data presented as Success/Not Success are presented in Table 4.2.

The chi square computed on the above data was highly significant (chi square = 34.57, $p = .000$, effect size = .031). A follow-up analysis indicated that both the SI and Traditional sections differed significantly from the individualized section. The MSI and Traditional sections, however, did not differ from each other.

The data presented in Table 4.3 disaggregate the No Success students into two groups.

Table 4.2: Student Success and Disaggregated Non Success as a Function of Group Placement

Comparison Groups	Mandatory Supplemental Instruction	Traditional	Individualized sections
Pass	76.8%	70.5%	50.5%
No Pass	9.8%	14.2%	12.2%
Percentage Other Grades (W, I, etc.)	13.4%	15.3%	37.3%

As before, the Chi square computed on the data was highly significant (chi square = 42.56, $p = .000$, effect size = .046). It is evident from the data in Table 4.3 that the major reason that the students in the Individualized sections did not succeed was because they either withdrew from the course or received a grade of Incomplete. Overall, the percentage of successful grades in the MSI group was higher than any other group although this did not differ significantly from the traditional group.

The second major research question is: Can success in sections MAT 060 with Mandatory Supplemental Instruction be predicted from demographic variables? To answer

this question, a binary logistic regression was conducted attempting to predict success in the MAT 060 from the relevant demographic variables. The variables used in this analysis included:

- Age
- Ethnicity (1 = Caucasian; 0 = Other)
- Gender (1 = Male; 2 = Female)
- Whether student is full-time or part-time (Full time = 1; Part time = 0)

As an initial analysis, Pearson correlations were computed between the variables listed above and whether the student had been successful in the class. These correlations are presented in Table 4.3.

Table 4.3: Correlations of Demographic Variables and Course Success

Variable	Pearson Correlation	Significance Level
Age	-.017	.572
Gender	.078	.010**
Ethnicity	.021	.486
FullTime/PartTime	.086	.004**

As demonstrated in Table 4.3, female students and students who are enrolled full time succeeded at a higher rate. Neither age nor ethnicity was related to course success. The binary logistic regression elaborated these findings. Specifically, the overall regression was highly significant ($p = .000$) explaining approximately 3% of the variance. Both gender and full-time status were significant in the equation.

Additional Research Questions

A series of additional research questions were investigated to further elaborate the data. The first question concerned whether success in the three types of instruction was moderated by student variables. The issue in these analyses is to see if certain types of students perform relatively better in some sections than other. To answer this question, the data were analyzed by two-way ANOVAs. Support for the idea that some types of instruction are better for specific student sub-groups is found by a significant interaction.

Student Achievement as a Function of Placement in Basic versus Developmental Math

Students at Suburban Community College are placed in math classes based on their performance on the screening test. The data in Table 4.4 presents the percentage of students who are successful in MAT 060 as a function of their class placement.

Table 4.4: Success in MAT060 as a Function Math Course Placement

Comparison Groups	Mandatory Supplemental Instruction	Traditional	Individualized Sections	Total for Class Type
Placed in Basic Math	63.2%	55.7%	49.3%	56.0%
Placed in Developmental Math	81.1%	70.5%	51.9%	69.7%
Total for Classroom Type	72.1%	66.0%	50.6%	

The two-way ANOVA results demonstrated a significant effect for Classroom type ($F = 9.04$, $p = .000$, effect size = .017) and Course Placement ($F = 8.21$, $p = .004$, effect size = .008) but a non-significant interaction ($F = 2.68$, $p = .069$). The data in Table 4.4 duplicate the results from the previous analysis showing that students perform better in the MSI and Traditional classes as compared to the Individualized section. In addition, students placed in Developmental Math achieved at a higher rate than students in Basic Math. However,

there is no evidence that one type of class is relatively better for students as a function of initial math level.

Student Achievement as a Function of the Algebra Placement Test

The achievement of students in MAT 060 as a function of their score on the Algebra placement test is presented in Table 4.5.

Table 4.5: Success in MAT 060 as a Function of Algebra Placement Test

Comparison Groups	Mandatory Supplemental Instruction	Traditional	Individualized Sections	Total for Algebra Placement
Scored 40-45 on algebra section of placement test	75.8%	69.8%	52.2%	69.2%
Scored 45 or higher on algebra section of placement test	86.7%	80.2%	59.2%	71.7%
Total for Type of Classroom	81.3%	75.0%	55.2%	

The two-way ANOVA conducted on the data in Table 4.5 produced only a significant main effect for type of classroom ($F = 9.89$, $p = .000$, effect size = .031). As before, the students in the MSI and Traditional sections outperformed the students in the individual sections. (Note: Because the sample is divided in different ways for these analyses, the means for type of classroom will vary. The pattern, however, will remain essentially the same across all of the analyses.)

Student Achievement as a Function of Gender

The performance of students in MAT 060 as a function of gender is presented in Table 4.6.

Table 4.6: Performance as a Function of Gender

Comparison Groups	Mandatory Supplemental Instruction	Traditional	Individualized Sections	Total for Gender
Male	76.3%	65.3%	51.5%	64.4%
Female	79.1%	75.0%	50.5%	68.2%
Total for Type of Classroom	77.7%	70.1%	51.0%	

For the data in Table 4.6, the ANOVA produced two significant effects: the effect for type of classroom was, as before, highly significant ($F = 9.65$, $p = .000$, effect size = .031). In addition, the main effect for gender was significant, although the effect was small ($F = 3.67$, $p = .042$, effect size = .003). As demonstrated in Table 4.6, females scored slightly higher than males.

Student Achievement as a Function of Race

The performance of students in MAT 060 as a function of their ethnicity is presented in Table 4.7.

Table 4.7: Performance as a Function of Ethnicity

Comparison Groups	Mandatory Supplemental Instruction	Traditional	Individualized Sections	Total for Ethnicity
African American	76.3%	65.3%	51.5%	64.0%
White	79.1%	75.0%	50.5%	67.2%
	78.0%	70.4%	48.5%	

The only significant effect in Table 4.7 is the main effect for type of instruction ($F = 9.48$, $p = .000$, effect size = .041).

Overall, the pattern of data in all of the analyses presented above is the same: the students in the MSI and Traditional sections outperform the students in the Individualized sections. While the students in the MSI sections typically are performing at a somewhat higher rate than the students in the Traditional sections, none of these comparisons is significant. Moreover, there is no evidence in the above data that specific student variables interact with type of instruction.

Results of Mandatory Supplemental Instruction Attendance vs. Grade Comparison

Data on the performance of students in the SI sections as a function of attendance are presented in Table 4.8. For this analysis, the average percentage of class attended for the successful and non-successful students was computed.

Table 4.8: Performance as a Function of Attendance

Success	Mean	N	Std. Deviation
Not Successful	35.53	19	27.492
Successful	82.37	62	11.028
Total	71.38	81	25.724

As demonstrated in Table 4.8, the successful students had an average attendance of 82.37%; non-successful students had an average attendance of 35.53%. The difference between the successful students and not successful students in comparison to their attendance and participation in Mandatory Supplemental Instruction sessions is significant. The students who regularly attended Mandatory Supplemental Instruction were the students

who experienced the most success. Attendance percentages for students who participated in the Traditional Classroom format and the Individualized format were not available due to instructor variation of policies and practices. Therefore, making Supplemental Instruction Mandatory was a benefit to this study in that students who were present did better than those who were not.

Results of the MSI Follow-Up Survey

A simple follow-up survey was administered to all students who participated in the MSI program at SCC. These surveys were given to students by the MSI leaders during the last week of classes. The data from the student survey and focus groups are presented in this section of the chapter. The data in Table 4.9 present the result to the question about what factors influences the students to sign up for SI.

Table 4.9: Factors Influencing Students to Sign up for MSI

	Number checking this item	Percent checking this item
It was mandatory – I was in Jump Start Math.	15	39%
Teacher recommendation.	6	15%
Presentation in my MAT 040 class.	0	0%
Advisor or counselor recommended this course.	18	46%
Have not taken math in a while, could use extra help.	12	31%
This particular class fit best in my schedule.	11	28%
A friend recommended this class to me.	1	3%
I did not know what I was signing up for.	8	21%
Other	7	18%

As seen in Table 4.9 above, the most commonly cited factors influencing students to sign up for SI were: advisor/counselor recommended this course (46%); it was mandatory – I

was in Jump Start Math (39%); and have not take math in a while, could use extra help (31%). The least commonly cited or lack of influence to students to sign up for MSI was the presentation given in their MAT 040 class (0%).

Table 4.10: Factors Influencing Students to Attend MSI

	Number checking this item	Percent checking this item
Getting to know the other students.	9	23%
Seeing how much math I was learning.	14	36%
The instructor stressed the importance and encouraged me to attend.	15	39%
The SI leader.	15	39%
The help before tests.	27	69%
SI attendance was counted in my MAT 060 grade by the instructor.	18	46%
The additional study skills that I learned.	19	49%
Help with my homework.	22	56%
It reinforced the material I learned in class and made me more confident.	25	64%
Pressure from family.	2	5%
Other	3	8%

The most commonly cited factors influencing students to attend MSI were: the help before tests (69%); it reinforced the material I learned in class and made me more confident (64%); and help with my homework (56%). The smallest factor influencing students to attend SI was pressure from family (5%).

Table 4.11: Has Mandatory Supplemental Instruction changed how you feel about math in general?

	Number checking this item	Percent checking this item
I am more confident and less anxious.	21	58%
My confidence and anxiety are about the same.	15	42%
I am less confident and more anxious	0	0%

When self-reporting on confidence in math after MSI, 58% of students reported more confidence as a result of SI. No students reported that MSI made them feel less confident and more anxious.

Table 4.12: Would you recommend MAT 060 with Mandatory Supplemental Instruction to another student?

	Number checking this item	Percent checking this item
Yes	38	97%
No	1	3%

Almost all students (97%) would recommend MSI.

The most important findings in this section are that the majority of students (69%) especially appreciated the help that MSI offered them on days before tests. It was also noteworthy that nearly all (97%) students would recommend MSI to a friend, but no (0%) students listed the presentation given at their MAT 040 class as a reason for signing up for the course.

Results of the Formal MSI Focus Group

Faculty members and administrators involved with the Achieving the Dream initiative held focus groups with all MSI sections toward the end of the semester. The same questions were asked to all sections of MSI. The number in parenthesis indicates the number of students giving that response.

1. Why are you taking MAT 060 with Mandatory Supplemental Instruction?

- (1) Due to placement test result
- (2) Registered at late registration or by mistake
- (2) Only class left to register for
- (4) Did not know there was an extra class
- (1) Required in Jump Start Program
- (3) Wanted to take the MSI
- (1) Told there is a high rate of students not passing MAT 060
- (1) Advisor recommended
- (1) To get back into school after a long time
- (1) Benefit to learn more

In response to the first open-ended question above, students seemed to respond in one of three ways. Eight of the above students reported registering for this particular course without knowing what they were registering for. Three of the responding students chose to take this course after being directed into the course by an advisor or teacher and the remaining five (5) students reported choosing MAT 060 with MSI in order to take the “high road” or make the “right choice” for their education. The one remaining student reported that he or she was taking this course “Due to [a] placement test result”, which was a misguided answer.

2. What benefits have you experienced because you are taking MAT 060 with MSI?

- (3) Helpful to talk to people, explain problems
- (1) Helps to hash out problems having
- (2) Review for a test
- (2) Helpful to take MSI before class
- (1) A structural environment to study in and review helpful
- (2) Wouldn't have passed without MSI
- (1) Games in MSI helped material to be more relatable and fun
- (1) Helps when doing homework
- (1) Both teachers are great. MSI instructor explains so well
- (2) MSI teacher speaks our language
- (1) Teachers give good examples

With the above question, students again chose one of three types of answers. Eight (8) students responding mentioned the merits of the inter-personal relationships within the MSI classroom – with the MSI Leader, the teacher and the other students. Five (5) students mentioned enjoying MSI sessions before the classroom instruction – especially on test days. Four (4) other students mentioned the appreciation of help geared specifically toward assignments, passing and homework.

3. What disadvantages have you experienced as part of a Mandatory Supplemental Instruction class?

- (8) Having to come every time, should be optional or only for reviews before the test
- (1) MSI time is Q-time, only time for lunch and extra credit activities
- (3) Activities are silly or pointless(i.e. games). Some is a waste of time.
- (1) Sometimes MSI Instructor doesn't stay on the topic at hand
- (2) Having math right after MSI is exhausting
- (1) Was an easy class, not necessary
- (1) We should get credit that applies to our degree

In regard to the above question, students tended to respond along the lines of four different trends. Eight (8) of the responses elicited from students showed their lack of enthusiasm about MSI being mandatory and another five (5) students stated that the activities were “not necessary” or a “waste of time”. Three (3) other responses dealt with time issues, such as having their only free time taken up with MSI and having the two classes back-to-back was exhausting. One (1) student felt that they should be receiving credit toward his or her degree for this MSI session.

4. Overall, how do you feel about mandatory supplemental instruction?

- (3) Good but needs a few modifications
- (2) Good, but prefers it not to be mandatory.
- (1) Would like it for other classes (i.e. BIO)
- (3) Shouldn't meet right after a test, nothing to go over
- (2) Better to have MSI after class so we can reinforce lesson

Overall, five (5) students chose to give a “good” feeling about MSI. The remaining six (6) students offered suggestions for future use.

As a result of this MSI Formal Focus Group, student attitudes and preferences about MSI were able to be noted and analyzed using their own words. It is noteworthy that an overall “good” feeling is derived from the students in these MSI sections despite the fact that many of them did not initially know what they were signing up for. It is also important to note that many student answers suggested their dislike in having MSI as “mandatory” for these groups of students.

Summary

The results of this study examining students enrolled in developmental math in the three different formats – Mandatory Supplemental Instruction (MSI), Individualized format and Traditional Classroom format - found that a statistically significant difference existed between the Individualized Format Classes and the Traditional and Supplemental Instruction classes. The MSI and Traditional sections, however, did not differ from each other. Students participating in the Individualized format of MAT 060 passed at a much lower rate than those participating in either MSI or the Traditional Classroom format. Students in the Individualized format also received the grade of “Other” more frequently

than the other two groups and many of these grades categorized as “Other” were actually a withdrawal or incomplete grade from the course.

The second major result of this study is that it was determined that success in MAT 060 with MSI can be predicted from gender and full-time/part-time status of the student. As the result of a Pearson correlation performed, female students and students who are enrolled full-time succeeded at a higher rate than their male and part-time counterparts.

The additional research questions investigated showed that none of the sub-groups benefited to a greater extent. It was also determined that students who attended the MSI and participated accordingly succeeded at a much higher rate than those whose attendance at the MSI sessions was low.

In addition to determining student success as a function of their placement, follow-up surveys and focus groups were conducted with students in the MSI groups. Data collected as ‘student responses’ showed that some students reported that MSI was helpful - especially on test days, that students would recommend MSI to a friend and reported an overall positive feeling about MSI.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

This culminating chapter further discusses the results of this study and introduces major implications for both practice and research as a result of this study. The first section introduces the major findings of the study and discusses these key findings within the current research on Supplemental Instruction and developmental math education. Both major research questions are answered, as well as the ancillary questions that emerged as a result of the data collected. The second section of this chapter utilizes the study results to identify and elaborate upon implications for practice. The final section presents ideas and implications for future research.

Summary of Study Results

The first major finding of this study was that the Mandatory Supplemental Instruction (MSI) group and the Traditional group did not differ significantly from each other. Both groups, however, were significantly better than the Individualized group. The difference was also demonstrated in the percentage of students obtaining “other” grades. Students in the Individualized group obtained a significantly higher percentage of “other” grades and a large percentage of these grades were the assigned grade of “withdraw”.

The second major finding of this study was that students within the MSI who were most successful tended to be female students with a full-time status. Neither age nor ethnicity was related to course success.

Additional research questions investigated after the collection of the data did not support the idea that some types of instruction are better for specific student sub-groups. It

was also determined that students who attended the MSI and participated accordingly succeeded at a much higher rate than those with poor MSI attendance rates.

In addition to determining student success as a function of their placement, follow-up surveys and focus groups were conducted with students in the MSI groups. Data collected as ‘student responses’ showed that students reported that MSI was helpful - especially on test days, that students would recommend MSI to a friend and reported an overall positive feeling about SI.

These findings are important because valuable information was learned about the three different formats of MAT 060 delivery at Suburban Community College – namely, that students enrolled in Individualized format are not succeeding at a rate similar to their peers who choose or are advised into the MSI format or the Traditional Classroom format. Although the data are not statistically significant in favor of the MSI, the data do indicate that students in the SI sections typically perform at a somewhat higher rate than students in the Traditional format. Since the sample size for some of these analyses was small, the power to detect a significant difference between the Traditional and MSI sections was limited. That being said, it is too soon to make a judgment on the MSI program. Although a great deal of data were collected and analyzed from this study, further data and monitoring on student persistence in college, transfer, success in subsequent math courses, success in other college-level courses, and graduation rates should be collected.

It is also important to note that the attitudinal responses of students were positive and in favor of the MSI program. Although the students were mandated to stay for an additional 50-minute class period two times per week, the students saw the benefit of this

additional time and especially appreciated some stress alleviation before tests and on problematic homework problems.

Study Results and the Relationship to the Literature

As the result of what Cohen and Brawer (2008) refer to as “the community colleges experiencing a metamorphosis similar...to that which affected the compulsory sector earlier at state-level testing, curriculum standards, and graduation requirements gained prominence” (pp. 424-425), Suburban Community College created this MSI program in order to fulfill any state or national request for “evidence of increased productivity and specific programmatic outcomes” (p. 431). A deficit in student success was observed in MAT 060, the developmental math course at SCC, and based on this data MSI was piloted as a possible option for increasing student success in this gate-keeper course.

Since only limited literature could be found on my specific population (Mandatory Supplemental Instruction) it is difficult to contextualize the results of this research into a larger theoretical setting. Although some literature cautions against the implementation of MSI and indicates that Supplemental Instruction as a program should not be viewed as compensatory, that students should not receive any extra credit for attending SI and that their reward should be one of intrinsic value, other literature suggests that further research on the effects of mandatory attendance of high risk students in SI would prove beneficial to developmental educators (Arendale, 2001; Stansbury; 2001). This study was an attempt at this further research on the effects of mandatory attendance at Supplemental Instruction, although the data derived suggest that even further research with this population is needed.

It was found that female students within both the Traditional Classroom format group and the MSI group performed better than their male peers, which is consistent with

the existing literature. A study conducted by the Ohio Board of Regents had already found that females were more likely to complete developmental courses than their male peers (Bettinger & Long, 2005). However, the same study reports that only half of all students are successful in completing the developmental education courses. In this study, nearly 76% of students in the MSI group and 71% of students in the Traditional Classroom format successfully passed this developmental education course. The results for the Individualized format were more consistent with this particular literature in that only 51% of students represented in that group successfully passed the course.

Although the difference between the success rates for Traditional Classroom format MAT 060 students and the MSI format students was not significant or even approaching significance, “In comparison with their non-SI counterparts, SI participants received higher final course grades and a lower percentage of withdrawals” (Arendale, 2001, p. 22). The data received at Suburban Community College are in congruence with the national data compiled by the University of Missouri-Kansas City, in that 76% of MSI students passed the course while 71% of the Traditional Classroom format and 51% of the Individualized format students passed successfully – the non-SI sections have a lower pass rate than the MSI group.

The results from this study are similar to a study conducted by Stone, Jacobs and Hayes (2000), where those “reported having attended SI, 92% indicated that they found SI to be helpful” (p. 34). Of the students actively attending MSI at SCC, 97% of the students reported SI as helpful and the students went on to report that MSI was particularly helpful before exams.

Although the data, from the perspective of SCC, could have predicted a positively significant difference between the MSI and the two non-MSI groups, it did not in the instance for reasons that may or may not include a) the novelty of the program, b) the varying degrees of faculty involvement, c) the novelty of the MSI Leaders, d) advising practices and more.

The MSI program was adopted by SCC a year before the data were collected for this study. The first year implementation of MSI was considered the “pilot” of the program and was run by an adjunct faculty member and graduate student. Although these data were collected after the official end of the “pilot” study, the data reflects the very first attempt at MSI as adopted by SCC in its first official semester being run by a newly appointed Director of Supplemental Learning Programs. This new administrator was hired at the end of July and all training, hiring, faculty collaboration and scheduling had to be in place by mid-August.

All faculty members involved in the MSI program at SCC collaborated well with the MSI Leaders and with the SI Supervisor, but this faculty involvement took place in varying degrees in respect to each faculty member. Some faculty members attended all MSI Advisory Committee Meetings, exchanged e-mails, met with the Director of Supplemental Learning Programs and SI Leader regularly, while others simply did what they could in order to “survive the MSI experience”. These varying degrees of involvement led to some minor incongruent policies throughout the delivery of MSI and may have contributed to the insignificant difference between MSI and the Traditional Classroom format.

Results may also have been affected by the novelty of the leaders chosen to facilitate the MSI sessions during this particular semester. After a promising set of data was gathered that first year, during which time MSI was being facilitated by a graduate student and an adjunct faculty member, it was decided by the faculty initiators and student success administration that the program should continue and be facilitated by student or peer facilitators – closer to the “pure” form of SI that was discussed earlier in this research. The shift from an experienced teacher/graduate student to adopting peer facilitators may have created a new way of delivering MSI and may have affected the results of this study.

The advisement into MSI sections (or the lack, thereof) could have contributed to a non-significant result between MSI and the Traditional Classroom format as well. Although the faculty and administration tried to reach all staff involved in advisement in order to share the advisement “procedure” for directing particular students toward the MSI sections, this did not always happen as SCC wished. Some students self-advised and were not sure what they were signing up for online, but went ahead and registered for the section since one of the time slots fit well into their schedule. Some counselors did not get the advisement procedure information and told students incorrect information on the program such as “you can choose one session or the other” or that MSI was voluntary. Still others did not know what the extra time slot listed in the course catalog and in the college’s registration system meant and thought that it was, perhaps, a mistake.

Very little about the Individualized format of developmental math was mentioned in the literature review section of this study. Although the flexibility and convenience of self-paced classes to developmental students was noted and the American Association of Community Colleges reports that “nearly half of institutions offered self-paced courses to

the students..”, it has been demonstrated at SCC that the self-paced Individualized format of MAT 060 does not aid in the success of those students taking advantage of it (Shults, p. 9).

One particular study supports the data collected at SCC in regards to the Individualized format of developmental math. According to Carr (2000), “Although the evidence supports that students enrolled in computer-based instruction perform equally well as compared to their lecture-based counterparts, there is a well-documented high dropout rate in courses delivered via computer-based instruction in general and distance-learning courses and programs in particular” (p. 3). In addition to this, “far less research has investigated the effectiveness of computer-based instruction specifically for students in developmental education” (Zavarella & Ignash, 2009, p. 2). As mentioned in Chapter 4, not only did the students in the Individualized format succeed at a much lower rate than those participating in the MSI or Traditional Classroom format, but they received the grade of “W” or withdrew from the class at a greater rate. The data analyzed for this present study are consistent with this piece of literature.

Implications for Practice

In reflecting on the results of this study, there are many implications for practice at Suburban Community College and other community colleges wishing to incorporate MSI and/or remedy existing issues with self-paced courses such as the Individualized format offered by SCC. One major reflection on the answer to the first research question, that student success results showed that MSI and the Traditional Classroom format did not differ significantly, can be that more can/should be done by the institution to strengthen the MSI program.

Few faculty members are participating with this new initiative with MAT 060. Those MAT 060 faculty members that are participating are chosen by the dean of the department to run this special section of math and, because it is marketed as “no additional work” for faculty members, no formal training or explanation is provided for these instructors. These specially-selected faculty members talk one-on-one with the Supplemental Instruction Supervisor, but no formal effort is made to gather all instructors heading up one of these sections. One possible approach to making the most of the MSI program and to possibly obtain better results for the associated sections is to formalize a short training/information session for all faculty members to attend. This way, all involved instructors will have a common forum to discuss SCC’s definition and view of Supplemental Instruction, how SCC is handling the implementation of MSI, what the faculty responsibility is and what the expectations of the department and dean are. In addition to this training, in-service sessions created specifically for these specially selected faculty members can be an option during designated in-service days. These sessions could be attended and participated in by the dean of the department, any Supplemental Instruction Leaders and the supervisor of the program.

Another issue experienced in the implementation of the MSI program is the advising and counseling of students and the lack of information on the different sections/formats of MAT 060 available to students to take. During the data collection in both the Formal Focus Groups and on the MSI Follow-Up Survey, many students reported that they did not know what section was a MSI Section and did not understand what they were signing up for. In addition to students being confused during self-advising, some of the full-time advisors and counselors at SCC did not know what the designated courses

were on the master class list and offered conflicting information to the students during the advisement period and/or at the late registration session. Although not formally reported through focus groups and/or surveys, students have also mentioned this same confusion when ending up in an Individualized format class. It would behoove SCC to consider the results of this lack of overt information – being experienced by students, staff and faculty members – and find a definitive way to handle this situation. Furthermore, the worth of MSI needs to be shared with students, faculty and advisors on a more college-wide scale so that students who would potentially benefit from this program can be advised into and encouraged into these sections. More specific information can be added online on the registration page, in student accounts, in the course catalog, on the college's website and in course description handbook.

In further attempts to clarify registration information for students, faculty and counselors, all groups should try to be addressed at events where many of the aforementioned would be in attendance. For example, faculty should be presented more information at the monthly faculty meetings and in the college's "advisement notes" that are e-mailed out each semester right before the advisement period begins. Full- and part-time counselors can be addressed at the monthly counselor's meeting and follow-up information can be sent through e-mail, to ensure that counselors on all campuses are informed of the program. Finally, students can be addressed in many different ways – at appropriate workshops, during college-wide programs, by hanging information around campus, in distributing flyers and making these Supplemental Instruction flyers available to all counselors and faculty advisors to refer to and refer students to during advisement

periods. Although random assignment would have been best for this study, it was not possible because of the registration circumstances at the community college.

Until now, the implications for future practice have concentrated on the MSI program and how gains might be made by the students taking advantage of these specialized sections. Although the subject and results of this research were not focused on how the students in the Individualized format performed, the fact remains that a great disparity was found between MSI/Traditional Classroom students and the Individualized students. That said, more initiatives should be focused on this particular program to increase student success in these Individualized format sections.

One such recommendation would be to include more than one instructor at each Individualized format meetings. Faculty members involved in teaching the individualized classes have informally reported the considerable chaos involved in teaching up to 27 students, normally on 27 different topics, in one computer lab at one time. This chaos may generalize over to the students enrolled in these sections and more timid students may not get the help or attention they need for a variety of reasons. If another instructor or even a teaching assistant was to be added to this format of MAT 060, students may have additional opportunities to ask questions during the finite time period that they spend in the lab. Such a program can be termed “Individualized Tutoring Assistants” and students who have successfully completed MAT 060, preferably in the Individualized setting, and have taken some subsequent math courses could serve as these paid tutoring assistants.

The real impact of MSI on student grades, attitudes, results in subsequent math courses and experiences remains to be seen in many cases, but if any of the aforementioned is enriched in future practice, SCC may find some encouraging results after this nascent

stage is completed and the “kinks” are worked out of this program. There are many options for altering the MSI program – only a few examples are mentioned in these recommendations. In the meantime, it would behoove SCC to use these data to formulate a plan – such as the one recommended above – to improve student success results in the Individualized MAT 060 format.

Implications for Future Research

Along with the recommendations presented above, there is a definite need for research on MSI – specifically how the program has been adapted by Suburban Community College - in the future. Because MSI is still in its infancy and the data analyzed for this study were data resulting from the first true semester of the program, ongoing data need to be collected on students. These data should include student MAT 060 grades, student attitudes and perceptions of MSI, student persistence and retention data after participating in MAT 060 with MSI, graduation rates and transfer rates of students involved in this program, student overall course grades (or overall GPA) and possibly some follow-up surveys for students to complete in subsequent semesters to determine if any of the strategies learned in MSI are helpful and generalizable to other classes in other disciplines. The data run for this study and the recently suggested data types should be analyzed every semester, especially after some of the aforementioned implications for practice have been adopted, to determine if the MSI treatment is, in fact, aiding in student success in MAT 060.

Due to time constraints and data accessibility issues at Suburban Community College, data on the success of students repeating MAT 060 (sometimes for the second, third or even fourth time) in the three different formats of the course were not available for

comparison. For the future, it would be beneficial to the institution to see if MSI (or Individualized or Traditional Classroom) is more beneficial to the students in need of repeating the course.

In addition to analyzing data for MSI with the MAT 060 population, some different permutations of Supplemental Instruction theory and practice – whether more along the lines of the “pure” form of Supplemental Instruction or more adapted to fit the needs of the Suburban Community College students, should be implemented in disciplines other than math and/or math courses other than MAT 060 – possibly some college-level courses. It is also possible to further adapt the delivery of MSI used by SCC to include other developmental areas such as Reading and Writing. When the generalization of Supplemental Instruction takes place, pilot studies should be run in the other subject/discipline areas to ensure smooth introduction of the chosen delivery method.

It may also be of great worth to SCC to investigate other possible developmental math supports in order to compliment the MSI program or even replace it (if the data remain insignificant). One such program that is being piloted at SCC is the Jump Start Math program. In Jump Start Math, students testing into MAT 040, which is the lowest level of developmental math and entitled “Basic Arithmetic”, attend an intensive nine-day program on the concepts presented and tested on for MAT 040. Only students with higher placement test scores are invited into this program – those who are “sitting on the fence” between MAT 040 scores and MAT 060 scores. At the end of the nine days, students are permitted to re-take the Accuplacer Placement Test and, if receiving a passing score, start in the next level of developmental math, or MAT 060 in the next semester. Results from

this pilot study have been encouraging, so a similar program for those students in the same score range who have tested into MAT 060 may be appropriate for this group of students.

Summary

In finding that no significant difference existed between the MSI group and the Traditional Classroom format group, but that the groups did differ significantly from the Individualized format, implications for further research and practice dealing with MSI and possible other developmental math programs are suggested.

Although it was not a surprising result of this study that the literature reviewed did not predict or go against the findings of the present study insofar as Supplemental Instruction was concerned, since Suburban Community College was taking a novel approach to the practice, it was interesting to concur with the literature on the Individualized format in that students in these self-paced classes tend to drop out at a higher rate than their Traditional Classroom counterparts.

Suburban Community College can take the novelty of the MSI program, the inexperienced status of the MSI Leaders, the differing faculty involvement and the lack of continuity in advisement practices into consideration when planning for subsequent semesters of MSI and in determining if the program does produce significant differences for certain groups of students. Groups of students that may benefit from MSI have not all been identified and further data in future semesters need to be collected on student persistence and retention, graduation/transfer rates, success in subsequent math courses and success in college-level courses in general. Consistent with the findings that students in the Individualized format of MAT 060 succeed at a lesser rate and tend to withdraw from the

course at a higher rate, the Individualized program should be scrutinized and other faculty-led initiatives or administrative initiatives should be focused on this format of the course.

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