# Using Supplemental Instruction to Increase Passing Rates of Developmental Algebra Courses in Community Colleges

by

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Abstract

Developmental mathematics courses are historically difficult classes for community college students. The failure rate of these courses is alarmingly high. Supplemental Instruction (SI) was developed to assist students in mastering the concepts and as result increasing the passing rates of these difficult courses. SI is a program that uses small peer-assisted study sessions to improve the problem solving skills and the retention of students in historically high-risk courses. Study sessions are led by a student instructor that previously took the class and earned a good grade. This thesis is a study of the efficacy of Supplemental Instruction on Elementary and Intermediate Algebra courses at a community college.

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Acknowledgements

I would like to thank my family and friends for their support throughout this journey. I would not have been able to complete this degree without them. My mother and father have played such a large role in supporting me throughout this entire process, so I thank them for their continuous encouragement. Most importantly I must acknowledge God and the role He has played in my life and my faith. Without Him, none of this would have been possible.

Chapter 1

Introduction

Students enrolling in college are underprepared or even completely unprepared for college (Hodges, p. 351). Dodge City Community College students are no different. The average failure rate, or more accurately rate of D's, F's and withdraws from the course (DFW rate), was 53.6% for the Elementary Algebra courses and 57.8% for the Intermediate Algebra courses at DCCC in the five years prior to this study.

In an attempt to reduce this failure rate at DCCC, Supplemental Instruction was used and studied in two different courses. Supplemental Instruction (SI) is an academic assistance program developed by Dr. Deanna Martin at the University of Missouri-Kansas City in 1973, (Arendale, p. 4). SI is supported by close to 40 years of research and practice in post-secondary education (Wright, p. 30). It is a program that uses peer-assisted study sessions to improve the retention of students in historically high-risk courses. These study sessions are led by students that previously took the class and did well. These students, known as the SI Leaders, attend class, take notes, complete the homework, and lead the class in SI sessions. SI is becoming recognized as a method of academic assistance for both underprepared and fully prepared students (Wright, p. 30). This is why SI was chosen as a good program to pilot in the spring semester of 2011.

This research project studied the effect of Supplemental Instruction on two historically difficult courses at DCCC: Elementary Algebra and Intermediate Algebra. A few adjustments were made in an attempt to assist with the integration into the current course design. A total of four sections were being studied: two Elementary Algebra and two

Intermediate Algebra sections. In each set of classes, one was the study group which used SI and the other was the control group which had no SI. Both sections were taught by the same instructor. This paper will discuss the methods used in the Supplemental Instruction at DCCC and the results that came of the semester-long study.

Chapter 2

Description of the Study

2.1 – Location of the Study

This research was conducted at Dodge City Community College (DCCC) in Dodge City, KS which is located in Ford County in Western Kansas 155 miles west of Wichita, KS. Western Kansas is a sparsely populated area that is comprised of farms and small towns. Most of the students at DCCC are residents of Ford County. Since the residents of that county attend college on a Ford County Scholarship, classes there are essentially free.

2.2 – Participants of the Study

The research was conducted on students enrolled in Elementary Algebra (Math 90) and Intermediate Algebra (Math 102). For clarity, the sections will be referred to as Math 90, Math 90 SI, Math 102 and Math 102 SI, respectively. Students were not made aware of the SI before enrollment; however, students in sections with SI were informed as to their participation in this study on the first day of class. If they did not wish to participate, they were given an opportunity to transfer to a different section. Therefore it should be noted that the SI students opted to stay in their section. The control group students were not made aware of the study.

The study groups were Math 90 SI and Math 102 SI with enrollment beginning at 28 and 11 respectively and ending at 18 and 9 respectively. The control groups were Math 90 and Math 102 with beginning enrollment at 29 and 15 respectively and ending at 18 and 13 respectively. The original design of the study was to have both sections of each course

taught by the same instructor to remove any differences in grading and teaching styles. This design was followed until unforeseeable circumstances occurred midway through the semester. These changes will be discussed in a latter section. Each SI class had a designated student SI Leader that was in charge of the sessions on Tuesdays and Thursdays.

## 2.3 Duration of the Study

Data collection occurred during the spring semester of 2011 which included the months of January 2011 to May 2011. Each course met five days a week. The following is the schedule of each of the courses:

| | | |
|---|---|---|
| Math 90 | M T W Th F | 9:30 – 10:20 AM |
| Math 90 SI | M T W Th F | 11:30 – 12:20 PM |
| Math 102 | M T W Th F | 8:30 – 9:20 AM |
| Math 102 SI | M T W Th F | 9:30 – 10:20 AM |

Data analysis occurred during the months of June 2011 to April 2012.

## 2.4 Outline of the Study Method

The two study SI sections had three days of lecture and two days of Supplemental Instruction. Mondays, Wednesdays, and Fridays were assigned to the instructor for lectures. Tuesdays and Thursdays were assigned to the SI Leader for the review sessions. The two control group sections had traditional lectures five days a week with a regular instructor.

The two SI leaders attended every lecture class, sat in the back of the room, took notes, completed the homework, but did not take the tests. The SI sessions were led by the SI Leaders alone. The instructors of the classes were not in the classroom, but they were available in their offices if there were any questions or concerns that needed to be addressed. For the first few weeks, the SI Leaders were observed for quality assurance. Any concerns or praises were documented and discussed either after class or in a meeting shortly afterward.

The SI Leaders were required to have a plan for each session. They typically would have example questions ready from the material covered already. Often, they would have activities planned that required group work or involved a game of some kind. If students had questions of their own, they would ask them at the beginning of the SI session. Once the questions were sufficiently answered, the SI Leader would implement the plan.

The two courses were handled differently. The Intermediate Algebra class (Math 102 SI) was given a quiz each SI session that was written by the course instructor. These quizzes counted for 10% of the students' grades. After the quiz, the SI Leader would ask if there were any questions. She would follow with example questions. Occasionally she would use a buzzer set-up to play a game of Math Jeopardy. Due to the small class size and low attendance, the entire 50 minutes of class time was rarely used.

The Elementary Algebra class (Math 90 SI) began each SI session with questions from the students. The SI leader would occasionally have a small review of the previous lecture(s). He would then follow with review questions. There were small personal white boards available to use, and he would frequently require each student to use one. Once a

question was put on the board at the front of the classroom, each student would be able to work the problem on their own white board. The SI leader would be able to scan the room for comprehension of the mathematical concept. If a wrong answer was written by a student, he could quickly spot the error because the writing was large enough to be legible from the front of the classroom. Once the review questions were exhausted or the activity was complete, class was dismissed after the entire 50 minutes.

Chapter 3

Method

3.1 – SI Leaders

The two SI Leaders were chosen through recommendations by instructors at the college. The Math 90 SI leader was known well by the selection committee and was easily accepted. However, there was confusion with the recommendation for the Math 102 SI leader, as there were multiple students with the same name. It was not discovered that the wrong person was hired until the problems with the SI leader had culminated. These issues will be discussed later in this chapter.

A meeting between the SI Leaders and instructors was arranged to take place before the first day of class to discuss the method of delivery for the Supplemental Instruction Program. The following list of expectations was presented to the SI Leaders:

1. Attend each class and complete homework as a student in the class
2. Lead SI Sessions with review problems, activities and a Q&A section for their own homework problems
3. Hold office hours at the Academic Success Center (ASC) for the students
4. Maintain a working relationship with the students so they will feel free to ask questions and not feel intimidated
5. Maintain a working relationship with the instructor with frequent, informal meetings to discuss the material and any difficult problems

The first expectation was a necessity because the SI Leader must have a mastery of the problems that will be discussed and a familiarity with the mathematical concepts and context. The second expectation was the bulk of the SI Leader's duties. These duties are outlined in Section 2.4. The office hours allowed the students to have access to the SI Leader outside of class and SI Sessions.

The last two expectations turned out to be much more important than we first realized. Without a good, working relationship with the students, the line of communication breaks down. Thus the entire purpose of supplemental instruction is defeated. The students must be comfortable enough with the SI Leader to ask questions even if they feel they are asking "dumb questions". The relationship between the SI Leader and the instructor is also extremely important. Since both are in front of the class leading in two different capacities, it is important that they are collaborating when it comes to instructional methods. There should be a mutual support shown at all times in and out of the classroom.

The mistaken identity of the Math 102 SI leader affected the quality of the program as she was not mature enough to handle the pressures of leading a class, and she had conflicts with the instructor. Rather than support the instructor with every chance given, she allowed the students to express their frustrations and then blamed the issues on the teacher. When these problems were discovered, there were multiple attempts to reove the issues between the SI leader and the instructor. The conflict was severe enough to warrant immediate termination. We even considered hiring a new SI Leader to complete the semester. However, the final decision was made not to make any changes and to work with

the SI Leader and the instructor on problem resolution. This situation makes our data less reliable.

3.2 – Instructors

Complete cooperation from the instructors was necessary for this research to take place. They willingly assigned 10% of the students' grades to quizzes administered during the SI Sessions, and granted access to individual grades. The final grades for all four classes were obtained for analysis. The instructors graded all homework, quizzes and tests.

This study had another incident that influenced the collected data. The Math 90 & Math 90 SI instructor had an extremely serious medical issue develop half-way through the semester that caused him to miss class for a week. During this time, both Elementary Algebra classes were not in session. They fell behind schedule quickly. The instructor did not return to teach the classes that semester, so replacements had to be found. Unfortunately two different instructors were assigned to the Elementary Algebra sections in this study.

Throughout the study the instructors were required to work closely with the SI Leaders; however, they were not required to initiate the communication between themselves and the SI Leaders. Originally, all of the studied courses were scheduled to meet five days a week. Since SI took each Tuesday and Thursday, the instructors had to compress the lecture material into three days a week while the other sections had five days to cover the material. This caused some issues when planning the course schedule. The SI courses were feeling rushed, while the control groups felt the pace of the class was too slow.

### 3.3 – Students

The students of the study groups were given surveys at the end of the semester to give their opinions of their experiences with Supplemental Instruction. The survey that was administered is in Appendix B. The summary of the results to the final two response questions are in Appendix C.

### 3.4 - Bias

An SI group and a control group for both courses were being studied and each set was being taught by the same instructor attempting to eliminate the bias created by the teaching and grading styles of different teachers. While this design stayed true for the Intermediate Algebra courses, the Elementary Algebra courses were forced to complete the semester with different instructors. This change mid-way through the semester very likely changed the outcome of test scores, material comprehension and possibly even the passing rates for the courses. Therefore our data may be less reliable than as originally planned.

Chapter 4

# Results

## 4.1 – Hypothesis

This thesis is using the null hypothesis that there is no significant difference in the tests scores between the study group and the control group before Supplemental Instruction, i.e. $H_0$: $\mu_{SI} = \mu_C$. The alternate hypothesis is that Supplemental Instruction improves test scores for the student enrolled in Elementary and Intermediate Algebra courses at a community college, i.e. $H_a$: $\mu_C < \mu_{SI}$.

## 4.2 – Introduction to Results

Each of the four classes was given six chapter exams and one final exam. We collected these scores and displayed them in Appendix D1 through G2. Students that did not complete the course were removed from the study. The average scores for each of the seven exams were plotted for the control groups versus the study groups. Statistical tests were calculated for the group test scores to decide on the significance of the results.

## 4.3 – Elementary Algebra Test Averages

Figure 1 displays the mean test results for the Elementary Algebra students. Test 1 was used as a pretest since it was administered early in the semester, and it covered review material. Further comparison showed that the scores for the first three tests were strikingly similar. Differences were noticed in the averages in tests 4 and 5. These could be attributed to the temporary absence of the instructor and reassignment of the courses to two different instructors.

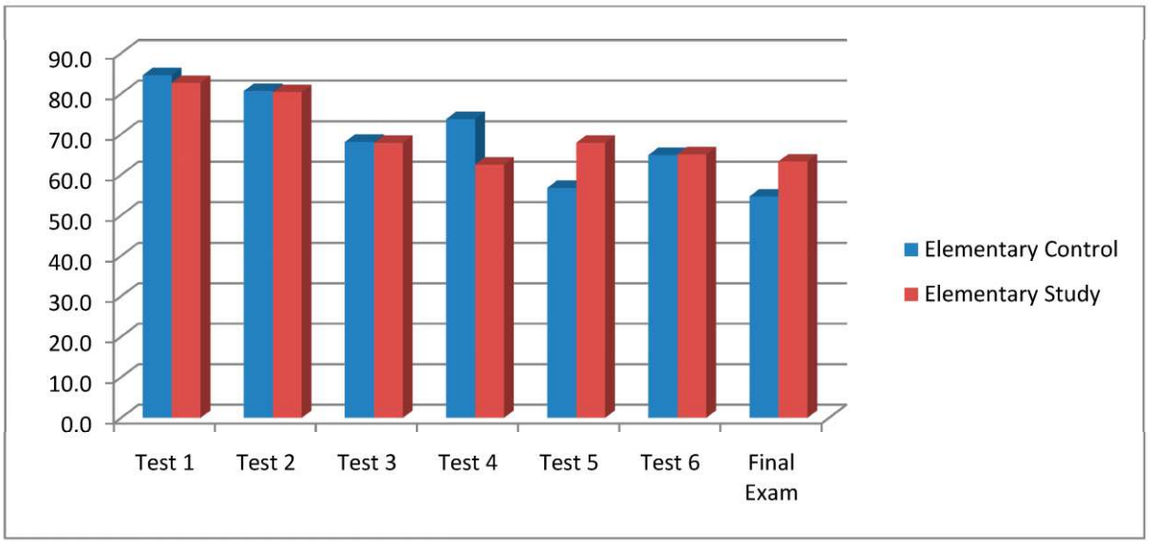


Figure 1
Means of Elementary Algebra Test Results

Figure 2 shows the graph of T-tests for each of the exams. This shows there is no significant difference between the scores of control and study groups since no p-value is less than .05. Note that the study group did better than the control group on the final exam.

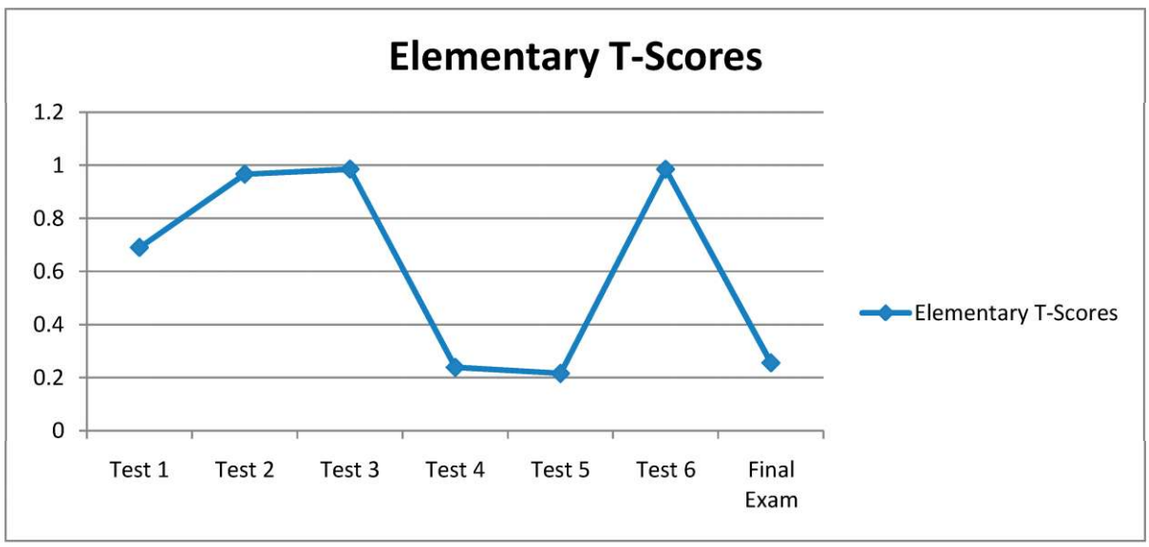


Figure 2
P-Values of Elementary Algebra Test Scores

4.4 – Intermediate Algebra Test Averages

Figure 3 displays all test results for the Elementary Algebra courses. Test 1 was used as the pretest. It is interesting to note that an unpaired T-test shows that initially the control group did significantly better than the study group; however, the study group performed better on every test after except for Test 3.

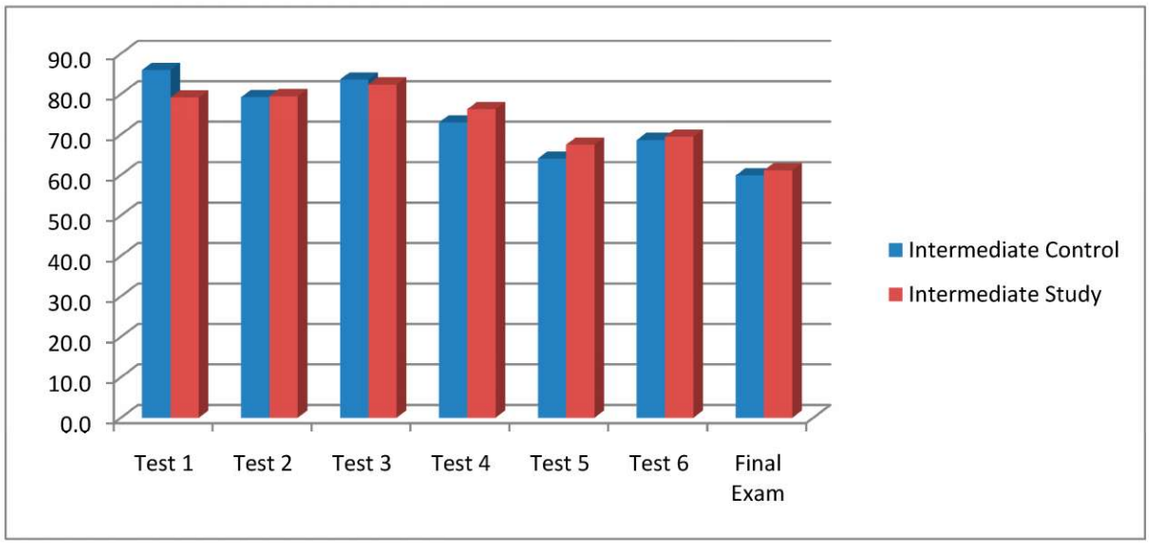


Figure 3
Means of Intermediate Algebra Test Results

Figure 4 displays T-test results. Note that Test 1 is the only statistically significant result. This shows that SI may have helped bring the study group's test scores up since the rest of the differences in scores were statistically insignificant. Hence the SI sessions served as an equalizer between the two classes.

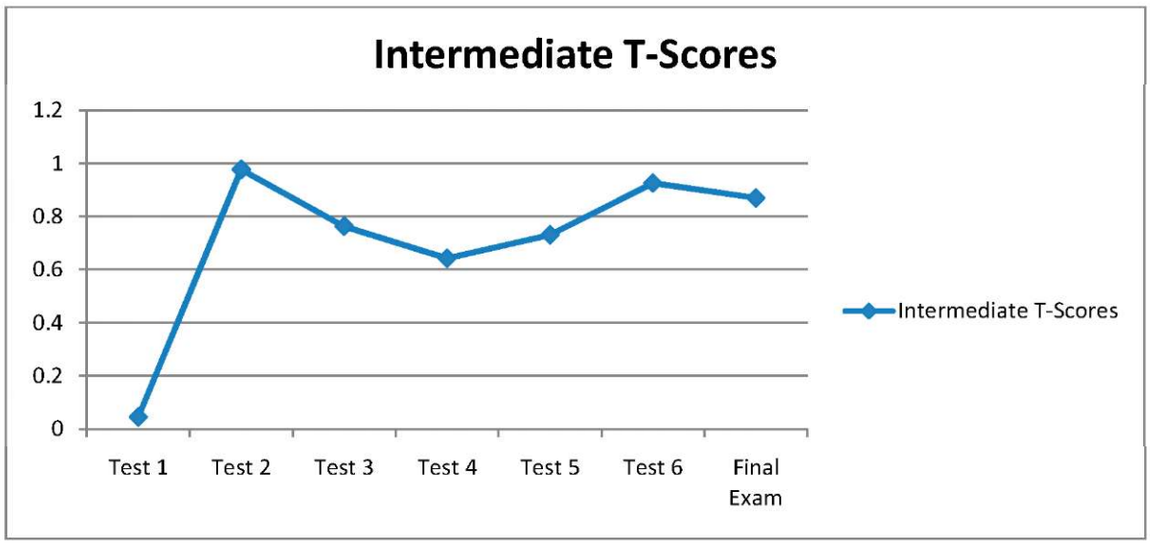


Figure 4
P-Values of Elementary Algebra Test Scores

4.5 – Elementary Algebra Survey Results

Each of the students in both study classes was given a 21 question survey to summarize their experience with Supplemental Instruction, see Appendix B. The most interesting results came from questions 20 and 21, stated below:

20. Do you feel like supplemental instruction has been beneficial to you so far? **YES** **NO**

    Please explain why or why not.

21. What suggestions do you have to improve the supplemental instruction program?

Twenty Elementary Algebra students responded with "YES" to question 20, and one student responded with "NO". All of the responses to both questions, including the explanations, are listed in Appendix C. The most notable answers are listed below:

- The SI Leader is actively involved.

- It's another way of being taught, and there's a bit more one-on-one time.
- The extra review and opportunity to ask questions on previous assignments is extremely beneficial for comprehending the material.
- Yes, because if I do not understand what the teacher said, I can always ask the SI Leader, besides I feel more comfortable with him because I feel he understands better what I have to ask.

The suggested improvements to the program from question 21 that the Elementary Algebra students had were the following:

- Make sure the material is worked over multiple times and is explained in a way people our age can relate to.
- Guide us a little better, more step-by-step.
- Do different examples and slow down.

Almost every Elementary Algebra student felt that Supplemental Instruction was helpful. Many students understood the goal of the program and appreciated the effort given to assist them.

The survey results from question number 17 which asked about the amount of time spent on homework were combined with final grades, and the results are displayed in Figure 5. The final grades are plotted with their corresponding group of time spent on homework. It is to be expected that the more time that is spent on homework should correlate well with a higher final grade in the course.

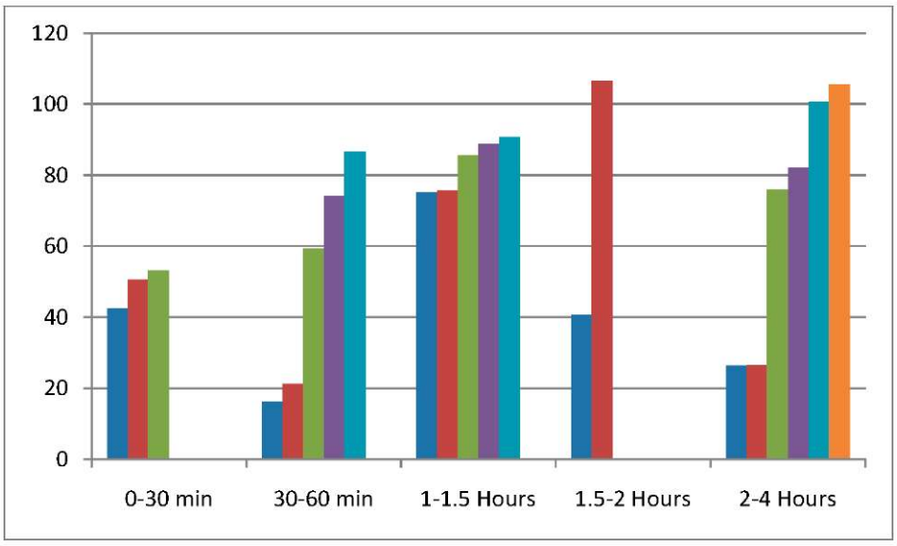


Figure 5
Time Spent on Homework vs. Final Grade in Elementary Algebra

The data does not support the previous conclusion because the correlation coefficient was very low. A possible explanation is that the actual time spent on homework and the amount of time claimed to be spent on it do not necessarily match. It was necessary to require a name on the surveys so a final grade could be matched with each survey. This requirement however, could have yielded less reliable results.

4.6 – Intermediate Algebra Survey Results

The Intermediate Algebra study group was significantly smaller in size than the Elementary Algebra study group. That is the reason for the completion of only six surveys from that class. When asked if SI was helpful, two students responded positively, while four responded negatively. The explanations given are the following:

- The student teacher and teacher aren't always on the same page.

- There is never a plan for the day. We always just wing it. Half the time we are confused, if it weren't for having to take the quiz, I probably wouldn't come.
- I feel like we are rushing things on MWF, but on the other days I don't feel the need to come because it's pointless because she doesn't teach me anything.

It is important to note that some of the negative responses could be attributed to the fact that the instructor and SI leader were not collaborating as was originally planned. These students had many suggestions to improve the program as well. A few of those suggestions are listed below:

- The student teacher and teacher need to go over more what will go on in each class. Making a plan for each chapter and knowing the material well.
- Have them actually teach us something, not just come in for 10 minutes and then leave. That's just a waste of time.
- Have a plan for us on Tuesdays and Thursdays.
- Just make it an optional program for students.

Most of the Intermediate Algebra students felt SI was a waste of time and did not benefit much from the program. These surveys are much more critical of the SI program due to the breakdown of communication between the SI Leader and the instructor. Many of these students have a very negative view of SI most likely due to the poor performance of the SI Leader thus reinforcing the importance of hiring a well-qualified SI Leader.

The dynamic in the Intermediate Algebra classroom could be likened to a family with two parents. The students sensed a weakness in one of the leaders, so they exploited

that weakness as much as they felt was possible. This dynamic must be avoided if Supplemental Instruction is to be successful in the classroom.

The survey results from question number 17 were combined with final grades from the Intermediate Algebra students that completed the survey. The results are displayed in Figure 6. The final grades are plotted with their corresponding group of time spent on homework.

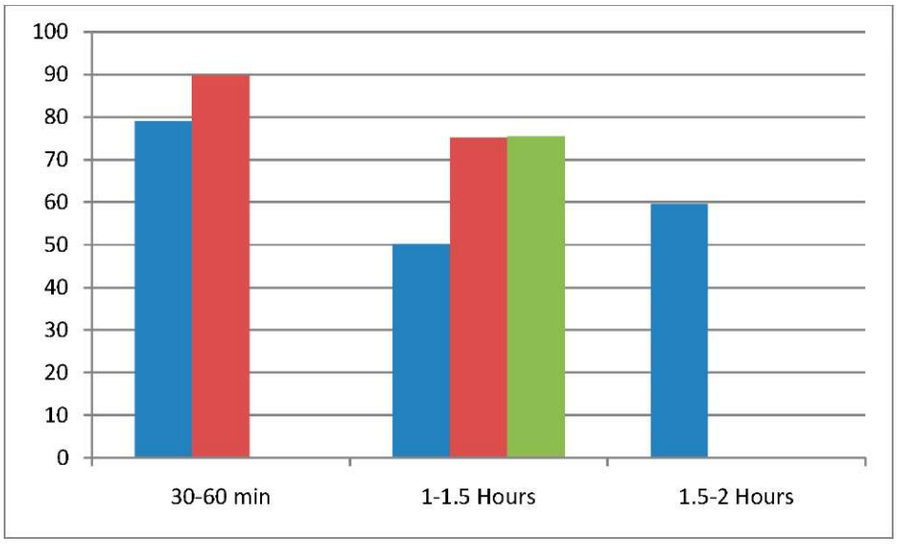


Figure 6
Time Spent on Homework vs. Final Grade in Intermediate Algebra

It can be noted that instead of a direct correlation between final grade and time spent on homework, an inverse relationship appears to be the case. These results are probably negligible due to the fact that a very small number of surveys were completed, and as in the other class, this is a subjective question that may not be reliable since a name was required on the survey.

# Chapter 5

# Conclusions

## 5.1 – Validity of Results

This thesis explored the use of Supplemental Instruction for remedial math courses in a community college. The results do not support the effectiveness of SI on student performance and increasing the passing rates. However, there is evidence to suggest that SI helped a study group keep up with a control group in the Intermediate Algebra classes. While the study was carefully planned, unexpected events affected the viability of the data. Better planning and a more controlled environment may improve the results.

## 5.2 – Additional Investigations

More study is needed to determine the usefulness of Supplemental Instruction in remedial math courses at a community college. Many ideas were brainstormed during this research that will most likely be implemented in future studies. First, the SI Leaders will need to have initial training prior to the start of the semester to prepare them for instructing a class and as a method to screen potential issues that may arise. The SI Leader must have a well-established, working relationship with the instructor of the course. He or she must collaborate fully with the instructor while maintaining effective teaching in the classroom. When an issue with an SI Leader arises, it must be dealt with immediately as it is likely to grow with time and affect the overall results of the program.

One suggestion that a student gave will be implemented in the next study at DCCC. Making SI optional to the students was the original idea of the grogram, however, with the special circumstances surrounding these courses, mandatory attendance was implemented.

Also, control questions should be added as a way to measure the increase of knowledge throughout the semester. These questions should be included in the pretest, chapter tests and the final exam. A successful SI program will yield gradually improved scores on those specific questions throughout the semester.

5.3 – Conclusion and Recommendations

As discussed in *Re-conceptualizing Mathematics Education as a Design Science* by Lesh and Sriraman, "the success of a program depends on how much and how well it is implemented." (Sriraman 131) A small implementation of Supplemental Instruction along with a group of instructors that did not have experience with SI might have played a part in the lack-luster success of the program. Lesh and Sriraman note that if only a portion of the program is implemented or if there is not full understanding and support from the college, then 100% success cannot be expected. There was not a lack of support from the college or from the administration. In fact, it was quite the opposite. Many staff and faculty members expressed an interest and a desire for the program to succeed. However, the program as a whole was not completely understood by the staff and faculty or even by the students enrolled in the program. There should be a greater effort put forth to educate all parties on the desired results and implementation procedures so more support may be given by everyone involved in and affected by the new program.

While our results do not specifically show significant improvement in the passing rates, many students involved in Supplemental Instruction expressed a positive outlook on the program. SI is a way to reinforce topics presented in lecture without the students feeling the pressure of the instructor's presence. More study will need to be done to determine the efficacy of Supplemental Instruction in remedial math courses at community colleges. Supplemental Instruction, however, is recommended as another tool for students to use in high-risk courses, as our results show that SI students do as well as students in regular classes. Also, for many of them, the SI environment was very beneficial, as they had another source of instruction in a more relaxed atmosphere.

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# Appendix A:

# Supplemental Instruction Evaluation Form

Supplemental Instruction Evaluation Form

SI Leader Information:

Name:_____Supervisor:_____ ___

Class:_____ Date:_____

Needs Work
Satisfactory
Excellent

Ratings:

_____ Does he/she arrive to class with plenty of time to prepare before the start time?_____

_____

_____ Is he/she prepared for class?_____

_____ Does he/she ask if there are any questions and answer them completely? _____

_____

_____ What are the activities planned for class?_____

_____

_____ Does he/she have control of the class?_____

_____ Does he/she give adequate explanations of the material?_____

_____ Does he/she have adequate knowledge of the section(s)?_____

_____ What is his/her overall attitude towards the students in the class?_____

_____

_____ Is he/she dressed appropriately?_____

Overall compliments:_____

_____

_____

Areas that need work:_____

_____

_____

# Appendix B:

# Supplemental Instruction Survey for Students

Supplemental Instruction Survey

Math 90 / Math 91

Spring 2011

Nathan Diehl / Ron Albrecht / Dylan Faullin

**Instructions:** Please put your name on this survey. This survey will help with the study of this class. Any information you give will be used to improve the current class and the class for next semester.

1. Where did you attend high school? _____

2. In which city and state is that high school located? _____

3. Did you graduate from high school? **YES** **NO** 4. What was your approximate GPA?_____

4. Did you get a GED? **YES** **NO**

5. What is the last math class you took before this? _____

6. What is your declared major at Dodge City Community College? _____

7. Do you plan on attending a 4-year university after attending DCCC? **YES** **NO**

   If "**YES**", what university do you plan on attending, and what is your planned major there, and if "**NO**", why not?

   _____

   _____

8. Are you the first member of your family to attend college? **YES** **NO**

9. How many units are you taking this semester? _____

10. Are you involved in any clubs or groups? **YES** **NO** If yes, please list them._____

    _____

11. How many hours a week to you spend at your job? _____

12. What is your stress level this semester? **Very Low** **Low** **Medium** **High** **Very High**

13. Are you a visual learner? **YES** **NO** Is it difficult for you to learn math? **YES** **NO**

14. Do you enjoy doing math? **YES** **NO**
    Why or why not?
    _____

15. Are you good at self-directed learning? (that is learning the material by yourself without the help of an instructor) **YES** **NO**
16. Which of these activities would help you learn in a math class?

    **Lecture** **Group Work** **Activities** **Computer Work** **Games**

17. In a week, approximately how much time do you spend on homework in this math class?

    **0-30 min** **30-60 min** **1-1.5 hours** **1.5-2 hours** **2-4 hours** **4+ hours**

18. Do you appreciate the help of an instructor when you are having trouble with a topic? **YES** **NO**

19. Is it difficult for you to express yourself in class if you have a question on the material? **YES** **NO**

    a. Do you wish you had a better way of asking your question on the material? **YES** **NO**

    b. What suggestions do you have to help you express your questions in class?

    _____

    _____

20. Do you feel like supplemental instruction has been beneficial to you so far? **YES** **NO**
    Please explain why or why not.
    _____

    _____

    _____

21. What suggestions do you have to improve the supplemental instruction program?
    _____

    _____

    _____

If you need any more room to complete your responses, please ask the instructor for more paper.

Thank you for your input! ☺

# Appendix C:
# Supplemental Instruction Survey
# Results for Analysis by SI Leaders and Others

Dear Reader,

Here are the survey results for the last two questions of the supplemental instruction survey distributed over the last week. I combined both classes' responses anonymously. I also numbered each person's response, typed YES or NO, and listed their comments for both sections. Any reference to the specific SI leader (either gender or by name) was replaced with "(the SI leader)". Any liberties taken to aid the understanding of the comments are in parentheses.

Here are the two questions in the order they were asked:

20. Do you feel like supplemental instruction has been beneficial to you so far? **YES** **NO**
    Please explain why or why not.
    _____
    _____
    _____
21. What suggestions do you have to improve the supplemental instruction program?
    _____
    _____
    _____

Please let me know if you have any questions about how this survey was administered. I also would LOVE to hear your feedback from these results! Please send thoughts, comments, suggestions, ideas, etc. to me via e-mail, phone, or conversation. I really want to make this program the best that it can be. Thank you for your help it achieving that goal!

Sincerely,

Nathan Diehl

1. YES
    a. Learn the material; they know what they're doing. (?)
    b. Maybe be more organized.
2. YES
    a. Yes, because reviewing the material helps me remember how to work the problem.
    b. I would say maybe just doing more problems in class. The problems that give us the most problems.
3. NO
    a. The student teacher and teacher aren't always on the same page.
    b. The student teacher and teacher need to go over more what will go on in each class. Making a plan for each chapter and knowing the material well.
4. NO
    a. There is never a plan for the day. We always just wing it. Half the time we are confused, if it weren't for having to take the quiz, I probably wouldn't come.
    b. Have a plan for us on Tuesday's and Thursday's. Help make us want to come to class.
5. NO
    a. I feel like we are rushing things on Monday, Wednesday, and Friday, but on the other days I don't feel the need to come because it's pointless because (the SI leader) don't teach me nothin'!
    b. Have them actually teach us something, not just come in for 10 min. and then leave. That's just a waste of time.
6. NO
    a. We don't learn any new material.
    b. Just make it an optional program for students. If you need help, come in; if not, see you later.
7. YES
    a. Extra help has always been provided when needed.
    b. Maybe slow down on instruction.
8. YES
    a. (The SI leader) is actively involved.
    b. (blank)
9. YES
    a. Helps us by not learning it.
    b. (blank)
10. YES
    a. Give another day with homework for questions and peer help.
    b. Figure out how each student learns because I honestly dislike group work. I like to work alone and ask questions when help is needed.
11. YES
    a. After the instructor explains what's in the chapter again, if you have questions it's like one-on-one.
    b. NK

12. YES
    a. Because it's another way of being taught and there's a bit more one-on-one time.
    b. (blank)
13. YES
    a. (The SI leader) explains very well, and will go over the work with you until you get it.
    b. Do different examples and slow down.
14. YES
    a. (The SI leader) explains homework, (it) help(s) me to understand (the) material.
    b. None
15. YES
    a. (blank)
    b. (blank)
16. YES
    a. Because they are here to help us.
    b. I improve my math.
17. YES
    a. It is helping me remember materials we did in the past.
    b. Guide us a little better, more step-by-step
18. NO
    a. No, because I still get confused over the material.
    b. Better notes.
19. YES
    a. (blank)
    b. Make sure the material is worked over multiple times and is explained in a way people our age can relate to.
20. YES
    a. Yes, the extra review and opportunity to ask questions on previous assignments is extremely beneficial for comprehending the material.
    b. I think it would help other students in the class to have them work through problems on the board.
21. YES
    a. Like if I don't understand something, I am able to get extra help or have someone else explain it in a different way for me to understand.
    b. I think it is good, how it is.
22. YES
    a. I can get extra help on homework.
    b. People that just come to class to chat with their buddies should leave the class.
23. YES
    a. Yes, because if I do not understand what the teacher said, I can always ask (the SI leader), besides I feel more comfortable with (the SI leader) because I feel that (the SI leader) understands better what I have to ask.
    b. None.

24. YES
    a. I understand a little more than I usually do.
    b. Describe things in detail a little better.
25. YES
    a. (The SI leader) has been very helpful; (the SI leader) explains every little detail. (Is) always willing to do the problem step by step.
    b. Just do some group work.
26. YES
    a. A little, it has because I took a class similar to (this class) and everything is easy to me.
    b. None.
27. YES
    a. Because it's been very helpful in the past.
    b. (blank)

# Appendix D1:

# Elementary Algebra Control Group Test Scores

| Elementary Algebra Control Group Test Scores | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 99 | 105 | 77 | 89 | 84 | 102 | 80 |
| 2 | 79 | 89 | 53 | 53 | 88 | 66 | 63 |
| 3 | 96 | 97 | 106 | 100 | 104 | 99 | 100 |
| 4 | 78 | 59 | 91 | 71 | 55 | 70 | 39 |
| 5 | 94 | 82 | 42 | 92 | 37 | 32 | 41 |
| 6 | 75 | 47 | 63 | 86 | 0 | 0 | 31 |
| 7 | 81 | 68 | 102 | 78 | 68 | 71 | 48 |
| 8 | 83 | 94 | 89 | 68 | 75 | 92 | 67 |
| 9 | 96 | 92 | 88 | 82 | 67 | 45 | 76 |
| 10 | 77 | 76 | 84 | 12 | 65 | 71 | 45 |
| 11 | 52 | 54 | 53 | 63 | 49 | 34 | 19 |
| 12 | 86 | 91 | 0 | 76 | 0 | 77 | 65 |
| 13 | 88 | 71 | 0 | 27 | 0 | 42 | 45 |
| 14 | 77 | 66 | 53 | 80 | 42 | 50 | 42 |
| 15 | 92 | 82 | 53 | 104 | 82 | 91 | 59 |
| 16 | 82 | 75 | 84 | 81 | 49 | 49 | 45 |
| 17 | 95 | 112 | 126 | 98 | 82 | 99 | 73 |
| 18 | 92 | 92 | 62 | 67 | 75 | 78 | 46 |
| 19 | 37 | 46 | 0 | 0 | 0 | 0 | 0 |
| 20 | 64 | 76 | 4 | 0 | 0 | 0 | 0 |
| 21 | 71 | 33 | 44 | 26 | 26 | 0 | 0 |
| 22 | 97 | 102 | 87 | 102 | 0 | 0 | 0 |
| 23 | 47 | 18 | 44 | 0 | 0 | 0 | 0 |
| 24 | 61 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 81 | 78 | 0 | 0 | 18 | 0 | 0 |
| 26 | 86 | 82 | 0 | 0 | 0 | 0 | 0 |
| 27 | 70 | 47 | 76 | 0 | 42 | 0 | 0 |
| 28 | 76 | 64 | 83 | 0 | 29 | 21 | 0 |
| 29 | 94 | 84 | 0 | 0 | 0 | 0 | 0 |

# Appendix D2:

# Elementary Algebra Control Group Test Scores without Zeros

| Elementary Algebra Control Group Test Scores No Zeros | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 99 | 105 | 77 | 89 | 84 | 102 | 80 |
| 2 | 79 | 89 | 53 | 53 | 88 | 66 | 63 |
| 3 | 96 | 97 | 106 | 100 | 104 | 99 | 100 |
| 4 | 78 | 59 | 91 | 71 | 55 | 70 | 39 |
| 5 | 94 | 82 | 42 | 92 | 37 | 32 | 41 |
| 6 | 75 | 47 | 63 | 86 | 0 | 0 | 31 |
| 7 | 81 | 68 | 102 | 78 | 68 | 71 | 48 |
| 8 | 83 | 94 | 89 | 68 | 75 | 92 | 67 |
| 9 | 96 | 92 | 88 | 82 | 67 | 45 | 76 |
| 10 | 77 | 76 | 84 | 12 | 65 | 71 | 45 |
| 11 | 52 | 54 | 53 | 63 | 49 | 34 | 19 |
| 12 | 86 | 91 | 0 | 76 | 0 | 77 | 65 |
| 13 | 88 | 71 | 0 | 27 | 0 | 42 | 45 |
| 14 | 77 | 66 | 53 | 80 | 42 | 50 | 42 |
| 15 | 92 | 82 | 53 | 104 | 82 | 91 | 59 |
| 16 | 82 | 75 | 84 | 81 | 49 | 49 | 45 |
| 17 | 95 | 112 | 126 | 98 | 82 | 99 | 73 |
| 18 | 92 | 92 | 62 | 67 | 75 | 78 | 46 |
| Averages | 84.6 | 80.7 | 68.1 | 73.7 | 56.8 | 64.9 | 54.7 |
| STDev | 11.3 | 17.6 | 33.3 | 23.9 | 31.2 | 27.8 | 19.8 |
| Median | 84.5 | 82.0 | 70.0 | 79.0 | 66.0 | 70.5 | 47.0 |

# Appendix E1:

# Elementary Algebra Study Group Test Scores

| Elementary Algebra Study Group Test Scores | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 95 | 104 | 0 | 75 | 87 | 81 | 61.5 |
| 2 | 99 | 105 | 115 | 96 | 87 | 95 | 94 |
| 3 | 71 | 59 | 98 | 69 | 66 | 79 | 48.5 |
| 4 | 86 | 99 | 60 | 68 | 69 | 60 | 66 |
| 5 | 97 | 110 | 121 | 100 | 91 | 88 | 100 |
| 6 | 98 | 91 | 104 | 92 | 95 | 76 | 90 |
| 7 | 94 | 85 | 87 | 91 | 74 | 63 | 61 |
| 8 | 91 | 81 | 70 | 92 | 60 | 72 | 74.5 |
| 9 | 59 | 33 | 73 | 47 | 54 | 27 | 37 |
| 10 | 93 | 109 | 121 | 91 | 92 | 101 | 109 |
| 11 | 92 | 97 | 88 | 73 | 78 | 79 | 81 |
| 12 | 83 | 68 | 46 | 49 | 44 | 38 | 53 |
| 13 | 84 | 78 | 51 | 52 | 71 | 79 | 53.5 |
| 14 | 82 | 72 | 0 | 0 | 72 | 70 | 60 |
| 15 | 59 | 61 | 27 | 18 | 49 | 44 | 26 |
| 16 | 59 | 55 | 39 | 36 | 25 | 31 | 32 |
| 17 | 99 | 88 | 107 | 74 | 77 | 81 | 65 |
| 18 | 47 | 52 | 15 | 2 | 31 | 7 | 27 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 81 | 52 | 31 | 0 | 0 | 0 | 0 |
| 21 | 56 | 21 | 27 | 0 | 0 | 0 | 0 |
| 22 | 69 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 85 | 74 | 47 | 0 | 0 | 0 | 0 |
| 24 | 33 | 0 | 56 | 4 | 0 | 0 | 0 |
| 25 | 76 | 63 | 20 | 62 | 63 | 2 | 0 |
| 26 | 52 | 23 | 32 | 15 | 13 | 0 | 0 |
| 27 | 28 | 6 | 8 | 6 | 14 | 0 | 0 |
| 28 | 76 | 87 | 78 | 29 | 58 | 0 | 0 |

# Appendix E2:

# Elementary Algebra Study Group Test Scores without Zeros

| Elementary Algebra Study Group Test Scores No Zeros | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 95 | 104 | 0 | 75 | 87 | 81 | 61.5 |
| 2 | 99 | 105 | 115 | 96 | 87 | 95 | 94 |
| 3 | 71 | 59 | 98 | 69 | 66 | 79 | 48.5 |
| 4 | 86 | 99 | 60 | 68 | 69 | 60 | 66 |
| 5 | 97 | 110 | 121 | 100 | 91 | 88 | 100 |
| 6 | 98 | 91 | 104 | 92 | 95 | 76 | 90 |
| 7 | 94 | 85 | 87 | 91 | 74 | 63 | 61 |
| 8 | 91 | 81 | 70 | 92 | 60 | 72 | 74.5 |
| 9 | 59 | 33 | 73 | 47 | 54 | 27 | 37 |
| 10 | 93 | 109 | 121 | 91 | 92 | 101 | 109 |
| 11 | 92 | 97 | 88 | 73 | 78 | 79 | 81 |
| 12 | 83 | 68 | 46 | 49 | 44 | 38 | 53 |
| 13 | 84 | 78 | 51 | 52 | 71 | 79 | 53.5 |
| 14 | 82 | 72 | 0 | 0 | 72 | 70 | 60 |
| 15 | 59 | 61 | 27 | 18 | 49 | 44 | 26 |
| 16 | 59 | 55 | 39 | 36 | 25 | 31 | 32 |
| 17 | 99 | 88 | 107 | 74 | 77 | 81 | 65 |
| 18 | 47 | 52 | 15 | 2 | 31 | 7 | 27 |
| Averages | 82.7 | 80.4 | 67.9 | 62.5 | 67.9 | 65.1 | 63.3 |
| STDev | 16.5 | 22.3 | 40.4 | 31.8 | 20.6 | 25.6 | 24.7 |
| Median | 88.5 | 83.0 | 71.5 | 71.0 | 71.5 | 74.0 | 61.3 |

# Appendix F1:

# Intermediate Algebra Control Group Test Scores

| Intermediate Algebra Control Group Test Scores | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 96 | 90 | 82 | 59 | 33 | 41 | 39 |
| 2 | 83 | 92.5 | 80 | 54 | 58 | 60 | 36 |
| 3 | 87 | 98 | 97 | 96 | 100 | 103 | 93 |
| 4 | 84 | 96 | 78 | 78 | 78 | 72 | 73 |
| 5 | 90 | 83 | 88 | 35 | 67 | 40 | 40 |
| 6 | 88 | 82 | 65 | 48 | 69 | 50 | 48 |
| 7 | 87 | 0 | 80 | 96 | 68 | 97 | 76 |
| 8 | 70 | 75 | 85 | 92 | 0 | 48 | 50 |
| 9 | 79 | 75 | 66 | 74 | 62 | 43 | 60 |
| 10 | 88 | 87 | 96 | 90 | 65 | 94 | 74 |
| 11 | 99 | 99 | 96 | 97 | 93 | 104 | 72 |
| 12 | 79 | 83 | 83 | 64 | 55 | 64 | 37 |
| 13 | 87 | 69 | 90 | 65 | 84 | 76 | 80 |
| 14 | 84 | 0 | 38 | 0 | 0 | 10 | 0 |
| 15 | 58 | 65.5 | 32 | 55 | 0 | 0 | 0 |

# Appendix F2:

# Intermediate Algebra Control Group Test Scores without Zeros

| Intermediate Algebra Control Group Test Scores No Zeros | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 96 | 90 | 82 | 59 | 33 | 41 | 39 |
| 2 | 83 | 92.5 | 80 | 54 | 58 | 60 | 36 |
| 3 | 87 | 98 | 97 | 96 | 100 | 103 | 93 |
| 4 | 84 | 96 | 78 | 78 | 78 | 72 | 73 |
| 5 | 90 | 83 | 88 | 35 | 67 | 40 | 40 |
| 6 | 88 | 82 | 65 | 48 | 69 | 50 | 48 |
| 7 | 87 | 0 | 80 | 96 | 68 | 97 | 76 |
| 8 | 70 | 75 | 85 | 92 | 0 | 48 | 50 |
| 9 | 79 | 75 | 66 | 74 | 62 | 43 | 60 |
| 10 | 88 | 87 | 96 | 90 | 65 | 94 | 74 |
| 11 | 99 | 99 | 96 | 97 | 93 | 104 | 72 |
| 12 | 79 | 83 | 83 | 64 | 55 | 64 | 37 |
| 13 | 87 | 69 | 90 | 65 | 84 | 76 | 80 |
| Averages | 85.9 | 79.2 | 83.5 | 72.9 | 64.0 | 68.6 | 59.8 |
| STDev | 7.4 | 25.5 | 10.3 | 20.6 | 25.8 | 24.2 | 19.2 |
| Median | 87.0 | 83.0 | 83.0 | 74.0 | 67.0 | 64.0 | 60.0 |

# Appendix G1:

# Intermediate Algebra Study Group Test Scores

| Intermediate Algebra Study Group Test Scores | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 74 | 93.5 | 72 | 79 | 48 | 79 | 45 |
| 2 | 74 | 54 | 78 | 69 | 53 | 60 | 40 |
| 3 | 77 | 73.5 | 93 | 59 | 74 | 71 | 69 |
| 4 | 79 | 87.5 | 86 | 100 | 95 | 98 | 81 |
| 5 | 78 | 69.5 | 76 | 73 | 62 | 66 | 61 |
| 6 | 88 | 81 | 79 | 71 | 87 | 77 | 72 |
| 7 | 68 | 68 | 76 | 74 | 34 | 35 | 48 |
| 8 | 83 | 95 | 85 | 71 | 66 | 65 | 50 |
| 9 | 91 | 93 | 96 | 90 | 88 | 74 | 84 |
| 10 | 77 | 75 | 83 | 58 | 0 | 50 | 0 |
| 11 | 78 | 0 | 0 | 0 | 0 | 0 | 0 |

# Appendix G2:

# Intermediate Algebra Study Group Test Scores without Zeros

| Intermediate Algebra Study Group Test Scores No Zeros | | | | | | | |
|---|---|---|---|---|---|---|---|
| Student # | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Final Exam |
| 1 | 74 | 93.5 | 72 | 79 | 48 | 79 | 45 |
| 2 | 74 | 54 | 78 | 69 | 53 | 60 | 40 |
| 3 | 77 | 73.5 | 93 | 59 | 74 | 71 | 69 |
| 4 | 79 | 87.5 | 86 | 100 | 95 | 98 | 81 |
| 5 | 78 | 69.5 | 76 | 73 | 62 | 66 | 61 |
| 6 | 88 | 81 | 79 | 71 | 87 | 77 | 72 |
| 7 | 68 | 68 | 76 | 74 | 34 | 35 | 48 |
| 8 | 83 | 95 | 85 | 71 | 66 | 65 | 50 |
| 9 | 91 | 93 | 96 | 90 | 88 | 74 | 84 |
| Averages | 79.1 | 79.4 | 82.3 | 76.2 | 67.4 | 69.4 | 61.1 |
| STDev | 7.2 | 14.2 | 8.2 | 12.2 | 20.4 | 16.9 | 16.2 |
| Median | 78.0 | 81.0 | 79.0 | 73.0 | 66.0 | 71.0 | 61.0 |