

# **KILGORE COLLEGE**

## Math Department Study Skills Research Project

Spring 2007

Office of Institutional Research  
1100 Broadway  
Kilgore, Texas 75662-3204

# Math Department Study Skills Research Study Project

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## I. INTRODUCTION

The Kilgore College (KC) Math Department embarked on a study skills research study at the beginning of Spring 2007. The Chair of the Math Department collected anecdotal evidence from math instructors suggesting that students in MATH 0308 and MATH 1314 do not have the proper study habits to yield positive test scores. With the hope of helping students become academically prepared, the Chair had all the MATH 0308 and MATH 1314 students write a summary after each math test on what they did to prepare for upcoming tests. The main goal of this process was to give students time to reflect on their behavioral pattern of studying and to encourage them to develop better study habits vital to earning or maintaining a passing grade. Prior to implementing this curricular activity of continuous reflective exercises, the Chair required all of the MATH 0308 and MATH 1314 instructors to present a unit on study skills to their students. This study skills initiative became the KC Math Department's 2007 Annual Improvement Plan (AIP).

## II. METHODOLOGY

In collaboration with the Director of Institutional Research, the Chair created a study skills self-evaluation survey modeled after the information on *Success in Mathematics* webpage posted by St. Louis University's Department of Mathematics and Computer Science (<http://euler.slu.edu/Dept/SuccessinMath.html>). The survey (see Appendix A) is not only a conglomeration of statements that are related to math study skills but also skills that involve studying for and taking math tests, and doing homework. Hence, this survey is divided into four categories:

1. Math study skills,
2. Problem solving,
3. Studying for a math test,
4. Taking a math test, and
5. Getting assistance.

The study skills self-evaluation survey uses a Likert-type scale where 5=always, 4=frequently, 3=occasionally, 2=hardly ever, and 1=never. The surveys were scanned and the data uploaded to SPSS.

The plan was to have students complete the study skills self-evaluation survey at the beginning and the end of the Spring semester. During the semester, students would be given a certain amount of time after each chapter test for written reflection. In their summary, they were asked to answer these four questions:

1. Describe how you prepared for this exam;
2. Describe the material that you felt most confident with from this exam;
3. Describe the material that you were not comfortable with from this exam; and
4. Describe any changes you plan to make that would help to improve your success on the next exam.

Once the students completed the pre- and post- tests, the surveys were returned to the Office of Institutional Research for analysis.

While it is unknown whether or not all the MATH 0308 and MATH 1314 instructors adhered to this improvement plan, a few instructors commented that their reflective exercises were conducted through the form of class discussion instead of a written summary. These instructors asked their students why they did not do well in class, and they would suggest to

their students different ways to study. These instructors also said that discussion on study skills occurred more frequently during the beginning of the semester. Toward the end of the semester, they asked their students to reflect on their own time on why they performed poorly.

All of the instructors were also involved in tracking their students' grades (See Appendices B and C). A tracking form was emailed to these instructors. They were to fill in their students' identification number, whether their students completed a pre-test or a post-test, and the students' spring semester final grade. Upon completion, the instructors were asked to submit the form via email attachment to the Office of Institutional Research. The information returned by the instructors was inserted into SPSS.

The pre- and post- test data are considered an ordinal<sup>1</sup> scale of measurement; therefore, a t-test<sup>2</sup> was conducted to compare the mean score of both tests. Each statement in all five categories had a pre- and a post- test score in addition to a mean difference score. The mean difference was calculated to determine the extent that the behavior of the students had changed from the beginning to the end of the semester. The p-value<sup>3</sup> is set at .05, meaning that if the p-value is less than or equal to .05, the mean difference is significant. Hopefully, through the unit on study skills and the reflective exercises, students would start to exhibit positive behavioral changes.

### III. DATA RESULTS

The data results are presented based on the final grade of the students. Students with an A, B, or a C at the end of the semester are in Group A. Students with a D, F, W, or an Incomplete (INC) at the end of the semester are in Group B.

#### 1. Group A: Students with Grade A, B or C

A total of 245 students in Group A completed the pre-test and the post-test. Not every student answered each statement. Therefore, in order to ensure the validity of each statement, only students who had completed the pre- and post- tests were analyzed. The mean difference scores are also included in this table below. The p-value is included only for mean difference scores that are significant.

	Total # of students	Pre-test Mean	Post-test Mean	Mean Difference	P-value (If significant)
<b>I. Math Study Skills</b>					
<b>1. I attended class every day and was on time.</b>	245	4.60	4.36	<b>-.24*</b>	.003
2. I was attentive in class and asked questions.	245	4.00	3.89	-.11	
<b>3. I took clear and complete notes.</b>	244	4.50	4.61	<b>.11*</b>	.038
4. I carefully re-read my notes the day they were taken.	242	3.16	3.24	.08	
<b>5. I re-worked examples presented in class.</b>	244	3.08	3.32	<b>.24*</b>	.003

<sup>1</sup> Ordinal number refers to a type of number to accommodate infinite sequences and to classify sets with certain kinds of order structures on them. Ordinals are an extension of the natural numbers different from integers and from cardinals (<http://en.wikipedia.org/wiki/Ordinal>).

<sup>2</sup> T-test is a number of procedures concerned with comparing two averages (<http://home.clara.net/sisa/t-thlp.htm>).

<sup>3</sup> "The p-value is the probability of obtaining a result at least as extreme as a given data point, *assuming* the data point was the result of chance alone. The fact that p-values are based on this assumption is crucial to their correct interpretation" <<http://en.wikipedia.org/wiki/P-value>>.

	Total # of students	Pre-test Mean	Post-test Mean	Mean Difference	P-value (If significant)
6. I prepared for class by reading ahead.	239	2.54	2.51	-.03	
<b>7. I completed the assigned homework before the next class period.</b>	237	4.38	4.08	<b>-.30*</b>	.000
<b>8. For every hour in class, I spent at least two hours outside of class studying.</b>	241	2.77	2.98	<b>.21*</b>	.006
<b>II. Problem Solving</b>					
1. I wrote complete solutions to all homework problems	241	4.32	4.23	-.09	
2. When working homework, I referred back to my notes to find similar problems.	245	4.57	4.62	.05	
<b>3. I sought help on homework problems I couldn't solve.</b>	245	4.22	4.06	<b>-.16*</b>	.019
4. I broke difficult problems down into pieces.	244	3.80	3.88	.08	
5. To organize information, I drew pictures or built tables.	243	3.08	3.13	.05	
6. I checked my answers.	243	4.19	4.17	-.02	
<b>III. Studying for a Math Test</b>					
1. I started studying <u>prior</u> to the night before the test.	244	3.73	3.64	-.09	
<b>2. I practiced homework problems and examples from class without using my notes.</b>	245	3.42	3.63	<b>.21*</b>	.009
<b>3. I studied not only problems, but also the procedures for working specific problems.</b>	244	3.69	3.91	<b>.22*</b>	.001
4. I memorized any formulas needed for the test.	245	4.36	4.43	.07	
5. After studying, I was confident that I knew the material.	245	3.89	3.84	-.05	
<b>IV. Taking a Math Test</b>					
1. Before starting, I looked over the test to get an idea of the type of problems and length.	243	3.70	3.63	-.07	
2. I worked the problems that I definitely knew first.	244	4.00	3.98	-.02	
3. If I got stuck on a problem, I moved on and came back to that problem later.	244	4.45	4.37	-.08	
4. I read every problem carefully.	244	4.48	4.53	.05	
5. I showed all my work.	241	4.46	4.44	-.02	
<b>6. I was aware of the time.</b>	242	4.19	4.02	<b>-.17*</b>	.020

	Total # of students	Pre-test Mean	Post-test Mean	Mean Difference	P-value (If significant)
7. I checked to see that my answers made logical sense.	243	4.21	4.19	-.02	
8. If I finished early, I checked back over all my work.	244	4.15	4.02	-.13	
<b>IV. Getting Assistance</b>					
<b>1. I sought help from my instructor.</b>	244	3.52	3.23	<b>-.29*</b>	.000
<b>2. I sought help from a tutor.</b>	242	2.12	1.95	<b>-.17*</b>	.048
3. I sought help from fellow classmates.	242	3.04	2.89	-.15	
4. I asked questions as soon as they came up.	244	3.38	3.37	-.01	
5. When asking questions, I was specific about what I didn't understand.	241	3.91	3.89	-.02	
6. When I went to my Instructor for help, I took a written list of specific questions.	244	2.32	2.36	.04	
7. After getting help, I immediately worked several similar problems.	244	3.30	3.16	-.14	

## 2. Group B: Students with Grade D, F, W, or Incomplete


A total of 94 students in Group B completed the pre-test and the post-test. Not every student answered each statement. Therefore, in order to ensure the validity of each statement, only students who had completed the pre- and post- tests were analyzed. The mean difference scores are also included in this table below. The p-value is included only for mean difference scores that are significant.

	Total # of students	Pre-test Mean	Post-test Mean	Mean Difference	P-value (If significant)
<b>I. Math Study Skills</b>					
1. I attended class every day and was on time.	94	4.45	4.21	-.24*	.001
2. I was attentive in class and asked questions.	94	3.64	3.76	.12	
3. I took clear and complete notes.	92	4.49	4.45	-.04	
4. I carefully re-read my notes the day they were taken.	93	3.28	3.44	.16	
<b>5. I re-worked examples presented in class.</b>	94	3.11	3.36	.25*	.046
6. I prepared for class by reading ahead.	90	2.56	2.58	.02	
7. I completed the assigned homework before the next class period.	92	4.29	3.91	-.38	
8. For every hour in class, I spent at least two hours outside of class studying.	91	2.70	2.90	.20	
<b>II. Problem Solving</b>					
1. I wrote complete solutions to all homework problems	92	4.00	4.15	.15	
2. When working homework, I referred back to my notes to find similar problems.	94	4.49	4.46	-.03	
<b>3. I sought help on homework problems I couldn't solve.</b>	94	4.17	3.88	-.29*	.007
4. I broke difficult problems down into pieces.	94	3.73	3.78	.05	
5. To organize information, I drew pictures or built tables.	92	3.03	3.11	.08	
6. I checked my answers.	93	4.16	3.95	-.21	
<b>III. Studying for a Math Test</b>					
<b>1. I started studying prior to the night before the test.</b>	94	4.02	3.80	-.22*	.040
<b>2. I practiced homework problems and examples from class without using my notes.</b>	94	3.17	3.41	.24*	.084
3. I studied not only problems, but also the procedures for working specific problems.	94	3.66	3.82	.16	
4. I memorized any formulas needed for the test.	94	4.12	4.07	-.05	
5. After studying, I was confident that I knew the material.	94	3.63	3.44	-.19	
<b>IV. Taking a Math Test</b>					
1. Before starting, I looked over the test to get an idea of the type of	94	3.81	3.82	.01	

	Total # of students	Pre-test Mean	Post-test Mean	Mean Difference	P-value (If significant)
problems and length.					
2. I worked the problems that I definitely knew first.	93	4.13	4.03	-.10	
3. If I got stuck on a problem, I moved on and came back to that problem later.	94	4.39	4.27	-.12	
4. I read every problem carefully.	94	4.40	4.35	-.05	
5. I showed all my work.	93	4.22	4.31	.09	
6. I was aware of the time.	91	4.04	4.20	.16	
7. I checked to see that my answers made logical sense.	94	4.04	4.00	-.04	
8. If I finished early, I checked back over all my work.	93	4.01	3.97	-.04	
<b>IV. Getting Assistance</b>					
<b>1. I sought help from my instructor.</b>	93	3.48	3.09	<b>-.39*</b>	.001
2. I sought help from a tutor.	94	2.73	2.57	-.16	
<b>3. I sought help from fellow classmates.</b>	92	3.22	2.98	<b>-.24*</b>	.048
4. I asked questions as soon as they came up.	94	3.34	3.23	-.11	
<b>5. When asking questions, I was specific about what I didn't understand.</b>	93	3.94	3.65	<b>-.29</b>	.018
6. When I went to my Instructor for help, I took a written list of specific questions.	93	2.35	2.45	.10	
7. After getting help, I immediately worked several similar problems.	94	3.46	3.33	-.13	



## 2. Group B: Students with Grade D, F, W, or Incomplete

<b>Positive Behavioral Changes</b>			
<i>Category</i>	<i>Statement</i>	<i>Mean Difference</i>	(+)
Math Study Skills	I re-worked examples presented in class.	.25	Most Changes
Studying for a Math Test	I practiced homework problems and examples from class without using my notes.	.24	
<b>Negative Behavioral Changes</b>			
<i>Category</i>	<i>Statement</i>	<i>Mean Difference</i>	
Studying for a Math Test	I started studying prior to the night before the test.	-.22	
Math Study Skills	I attended class every day and was on time.	-.24	
Getting Assistance	I sought help from fellow classmates.	-.24	
Getting Assistance	When asking questions, I was specific about what I didn't understand.	-.29	
Problem Solving	I sought help on homework problems I couldn't solve.	-.29	
Getting Assistance	I sought help from my instructor.	-.39	

Group A seems to have developed better study habits than Group B. Group A demonstrated five positive behavioral changes. These students took clearer and more complete notes during class. They also spent more time outside of class to study. They revisited and reworked math problems that were presented in class, and they made sure that they understood the procedures for solving mathematical problems. On the other hand, Group B only made two positive behavioral changes. They reworked examples presented in class and learned to practice homework problems without having to always refer back to their notes.

While Group A has more positive changes than Group B, both groups made the same positive behavioral changes. Groups A and B learned that reworking examples in class and doing homework without constantly referring back to their notes were effective methods of studying. It is, however, uncertain whether or not instructors chose to focus on these two methods of study skills when they discussed with their students on ways of studying.

The lack of consistent attendance appears to be a common issue for both Group A and Group B. Students in both groups did not attend every class and were not always on time. Both groups also seemed to be reluctant to seek help when they did not fully understand a mathematical concept or could not solve a math problem. It appears that the students chose to work independently even if they had to spend more hours on their own, instead of seeking a tutor or visiting their instructor during office hours.

The majority of the positive behavioral changes are in the “math study skills” and “studying for a math test” categories. As shown in the survey, the survey categories not only have “math study skills” and “studying for a math test” but also other areas that measure one’s ability to successfully solve math problems and to be tested. While instructors may have spent time reviewing various skills with their students, it is possible that the time spent during the reflective exercises was mainly focused on math study skills instead of facilitating discussions that included other categories on the survey. For example, one of the categories is “taking a

math test.” Skills needed to take a test may not be the same as skills needed to study for a test. If test-taking skills were not mentioned during this curricular activity and if students were not aware of such skills, they would not have known how to take a test even though they may have spent many hours preparing for it.

## **V. CONCLUSION**

The purpose of this research was to determine whether or not the additional curricular activity of reflective exercises would lead to positive behavioral change. However, it has also revealed that having clear information about the skills essential for academic success and providing specific examples to students can affect students in their gradual process of developing better study habits. Future improvement plans, therefore, can focus on a more prescribed study-skills curricular plan with informative discussion that must be adhered to by participating instructors.

# **APPENDICES**

## APPENDIX A. Mathematic Study Skills - Self Evaluation

Based on your prior experience in high school or college level math courses, please rate the following statements from 1 to 5 according to how often you performed the tasks where 5 is **always** and 1 is **never**.

<b>I. Math Study Skills</b>	Never	Hardly Ever	Occasionally	Frequently	Always
9. I attended class every day and was on time.	①	②	③	④	⑤
10. I was attentive in class and asked questions.	①	②	③	④	⑤
11. I took clear and complete notes.	①	②	③	④	⑤
12. I carefully re-read my notes the day they were taken.	①	②	③	④	⑤
13. I re-worked examples presented in class.	①	②	③	④	⑤
14. I prepared for class by reading ahead.	①	②	③	④	⑤
15. I completed the assigned homework before the next class period.	①	②	③	④	⑤
16. For every hour in class, I spent at least two hours outside of class studying.	①	②	③	④	⑤
 <b>II. Problem Solving</b>	<b>Never</b>	<b>Hardly Ever</b>	<b>Occasionally</b>	<b>Frequently</b>	<b>Always</b>
7. I wrote complete solutions to all homework problems.	①	②	③	④	⑤
8. When working homework, I referred back to my notes to find similar problems.	①	②	③	④	⑤
9. I sought help on homework problems I couldn't solve.	①	②	③	④	⑤
10. I broke difficult problems down into pieces.	①	②	③	④	⑤
11. To organize information, I drew pictures or built tables.	①	②	③	④	⑤
12. I checked my answers.	①	②	③	④	⑤
 <b>III. Studying for a Math Test</b>	<b>Never</b>	<b>Hardly Ever</b>	<b>Occasionally</b>	<b>Frequently</b>	<b>Always</b>
6. I started studying <b>prior</b> to the night before the test.	①	②	③	④	⑤
7. I practiced homework problems and examples from class without using my notes.	①	②	③	④	⑤
8. I studied not only problems, but also the procedures for working specific problems.	①	②	③	④	⑤

9. I memorized any formulas needed for the test.      ①                      ②                      ③                      ④                      ⑤

10. After studying, I was confident that I knew the material.      ①                      ②                      ③                      ④                      ⑤

**IV. Taking a Math Test**

Never                      Hardly Ever                      Occasionally                      Frequently                      Always

9. Before starting, I looked over the test to get an idea of the type of problems and length.      ①                      ②                      ③                      ④                      ⑤

10. I worked the problems that I definitely knew first.      ①                      ②                      ③                      ④                      ⑤

11. If I got stuck on a problem, I moved on and came back to that problem later.      ①                      ②                      ③                      ④                      ⑤

12. I read every problem carefully.      ①                      ②                      ③                      ④                      ⑤

13. I showed all my work.      ①                      ②                      ③                      ④                      ⑤

14. I was aware of the time.      ①                      ②                      ③                      ④                      ⑤

15. I checked to see that my answers made logical sense.      ①                      ②                      ③                      ④                      ⑤

16. If I finished early, I checked back over all my work.      ①                      ②                      ③                      ④                      ⑤

**IV. Getting Assistance**

Never                      Hardly Ever                      Occasionally                      Frequently                      Always

8. I sought help from my instructor.      ①                      ②                      ③                      ④                      ⑤

9. I sought help from a tutor.      ①                      ②                      ③                      ④                      ⑤

10. I sought help from fellow classmates.      ①                      ②                      ③                      ④                      ⑤

11. I asked questions as soon as they came up.      ①                      ②                      ③                      ④                      ⑤

12. When asking questions, I was specific about what I didn't understand.      ①                      ②                      ③                      ④                      ⑤

13. When I went to my Instructor for help, I took a written list of specific questions.      ①                      ②                      ③                      ④                      ⑤

14. After getting help, I immediately worked several similar problems.      ①                      ②                      ③                      ④                      ⑤

Modeled after Saint Louis University's Department of Mathematics and Computer Science "Success in Mathematics" webpage at: <http://euler.slu.edu/Dept/SuccessinMath.html>.

**APPENDIX B**
**Mathematics Study Skills Research Study  
Step-by-Step Instruction Checklist**

January 9, 2007

Dear Instructors:

This is a step-by-step instruction sheet to help you complete the tracking form and administer the pre- and post- tests to your students. The purpose of this form is not to create more work but to simplify the process and ensure that the time you spend on this evaluation process will produce accurate data. By following the steps below, the survey results will be more reliable and valid. The table below has two columns. The second column can be used to check off (✓) activities once you have completed them. Also, make sure to follow each step in numerical order.

<b>Step 1.</b> Each instructor should receive the Step-by-Step Instruction Checklist (this sheet), the Student Tracking Form, and the surveys to administer to his/her students. Prior to administering the surveys, complete the top half of the Student Tracking Form. Put your name after "Form Completed by," and put down the course and section numbers that you teach. Next to "Date Pre-test was administered," put down the date when you will administer the pre-test. NOTE: you can choose to write or type. If you choose to write, you will need to go back and type and save the file as an EXCEL file.	<input type="checkbox"/>
<b>Step 2.</b> After you have completed the first half, you are ready for the second half! Notice that each survey has a survey number. You will put the students' name next to each survey number. If you have fifteen students, write down the names of all fifteen students. Make sure to include their student ID numbers. If you have students who were just added to your class, have them complete the survey on their first day of class. Don't forget to write their name and ID number on the Student Tracking Form.	<input type="checkbox"/>
<b>Step 3.</b> Prior to administering the surveys, briefly explain to your students the purpose of this survey. You do not need to go into details. A general idea is good enough, to help ensure that the students will answer each question honestly.	<input type="checkbox"/>
<b>Step 4.</b> On the day of survey administration, give each student a survey based on his/her survey number. For example, if you put Joe Smith next to Survey #1, give Joe the survey with that number. <i>This is a critical step, because Joe Smith will, again, receive Survey #1 for post-test. This is the only way to match the pre-test to the post-test.</i>	<input type="checkbox"/>
<b>Step 5.</b> For the students who have completed and returned the survey to you, write a "1" under the "Pre-Test Administered" column. For surveys not returned, put "0." Your pre-test column should all have 1s, unless a student was added to the class toward the very end of the semester or, for some reason, did not complete a pre-test.	<input type="checkbox"/>
<b>Step 6.</b> Once all the students have completed the surveys, send all the surveys to the IR office. The IR office is on the 2 <sup>nd</sup> floor of the Devall Student Center. Make sure you have received all the surveys administered for pre-test.	<input type="checkbox"/>
<b>Step 7.</b> By now, you should already have the Student Tracking Form filled out. If you filled out the form with a pencil or a pen, type the form and save the file. The form will be sent to you via email attachment, so you do not need to recreate the form. When it is time for the post-test, you will need to go back to this file and complete the post-test portions.	<input type="checkbox"/>

By following the seven steps, you should have successfully administered and collected the pre-tests. You will use the same Student Tracking Form for the post-tests. Follow Steps 4 to 7 to complete post-test-related activities. Make sure to also put down students' final grade. When you are finished, send your Student Tracking Form to Jennifer Su Yen via email at [jyen@kilgore.edu](mailto:jyen@kilgore.edu).

**You are done!**

## APPENDIX C

### IMPORTANT! PLEASE READ!

#### Mathematics Study Skills Research Study Step-by-Step Instruction Checklist for Post-test

April 24, 2007

Dear Instructors:

By now, you should have already administered the pre-tests and submitted them to the IR Office. You should also have a list of the students in your class who completed the pre-tests. An electronic copy of this list, also known as the *Student Tracking Form*, is kept in your hard drive, because you have typed the names of the students and their ID numbers on the list (this form was sent to you via email attachment in the beginning of this semester). You have also entered "1" next to their name and student ID if these students completed the pre-test. Please follow the steps below to conduct the post-tests. Please feel free to use the check box at the second column to help you remember what step is completed.

<b>Step 1.</b> Pass out each survey to the appropriate student based on his/her pre-test survey number on the list, which you have kept. <i>For example, If Joe Smith had pre-test survey number 1, you will give Joe Smith survey number 1 for post-test.</i>	<input type="checkbox"/>
<b>Step 2.</b> You might have students who completed the pre-test but no longer are in you class. These students were assigned a pre-test survey number. Disregard those surveys and DO NOT use them. <i>For example, If John Doe was pre-test survey number and he was withdrawn from the class, do not use survey number 2 for post-test.</i>	<input type="checkbox"/>
<b>Step 3.</b> You might also have students who did not complete the pre-test but are currently in your class. Give them a post-test with a survey number that was not assigned to a student during pre-test. <i>For example, Matt Adams did not complete a pre-test. The last survey number that was assigned to a student during pre-test was 16. You will assign Matt Adams as number 17.</i>	<input type="checkbox"/>
<b>Step 4.</b> IMPORTANT: Remember that each student will be given a post-test even if the student did not complete a pre-test. Also, you will be handing each survey with the correct number to the appropriate student.	<input type="checkbox"/>
<b>Step 4.</b> For the students who have completed and returned the survey to you, enter "1" under the "Post-Test Administered" column on the <i>Student Tracking Form</i> . Enter "0" for students who did not complete the post-test. At the end of the semester, enter each student's final grade. When you have completed the <i>Student Tracking Form</i> , send an electronic copy by email attachment to me at <a href="mailto:jyen@kilgore.edu">jyen@kilgore.edu</a> . Please submit the form before May 31 <sup>st</sup> .	<input type="checkbox"/>
<b>Step 5.</b> Once all the students have completed the post-tests, send all the surveys to the IR Office. The IR Office is on the 2 <sup>nd</sup> floor of the Devall Student Center. All packages must be received by May 31 <sup>st</sup> .	<input type="checkbox"/>

Be sure to follow each step, because this is the **only** way to track students. Data from surveys that were administered incorrectly cannot be used. If you have any questions, please feel free to contact me at extension 8620. Thank you for your collaboration.

Jennifer S. Yen