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**Spring Semester 2011 Math 110 (Introduction to Statistics)**

**Course Summary Report**

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***Executive Summary***

Introduction to Statistics (Math 110) prepares students to become critical decision makers based upon learning how to calculate and analyze key statistics. These concepts help in proving whether financial systems, profits, grades, viewer ratings, and patient’s vitals are within an acceptable range and help accountants, teachers, reporters and nurses make sound decisions. Statistics can be utilized by and is critical to all professionals. The importance of statistics in real-world applications has been strongly reinforced by making connections with the students’ majors and Math 110 course content. The overall goal is to help students master this material giving them the opportunity to make decisions based upon proven statistical concepts. This is being accomplished by students having a successful Spring semester with an average letter grade of B among all three sections taught.

***Approach***

The instructor set a high expectation of excellence by building upon the students’ strengths and encouraging them to work through their challenges. In each class, the students were encouraged to actively participate by doing problems on the board as well as answer content questions asked by the instructor. Assignments, quizzes, exams and a project were all developed keeping in mind the performance outcomes of the content in the preceding chapters. The students saw multiple representations of material that they had challenges mastering. Adjustments were made based upon summary grades before moving forward to the next course objective.

Math 110 (sections 1, 4 and 5) was taught by a Math Specialist using course objectives and goals developed by the Math department. This ensured standardization and consistency between sections. The major difference was in the use of a web-based educational tool (MyStatLab). A similar product (MyMathLab) has been used in the pre-foundational courses and was adopted for the first time for Math 110. This tool allowed the students to utilize an online study plan, receive instant feedback on their homework assignments and receive instructor input in a timely manner. This gave the students another tool helping them to be more successful.

***Findings***

The observations and data collected on student outcomes will show a very strong statistical foundation was developed for most of the Math 110 students taking this course. The majority of the course objectives were met with a few chapter concepts that need to be improved upon. Three sections were taught and those course averages ranged from 80%-84%. Attendance was even higher ranging from 84% - 88%. The following key findings are summarized below.

* **Freshmen had among the highest overall grades.** The first year students had very strong Math backgrounds and in 2 out of the 3 sections had the highest final grade averages of a B. Juniors ranked either 1st or 2nd with B letter grade averages as well. Sophomores consistently had the lowest grade point averages of a C. Most of second year students took pre-foundational courses prior to taking Math 110 and may need more support.
* **Students earning a C or less in Math 109 have a 55% risk of receiving C or less in Math 110.** Also, students who earned a D+ or less in Math 109 have a 50% chance of earning the same or less in Math 110. Freshmen especially need more support if they earned a D in Math 109. Only one student earning a D+ in Math 109 earned an A- in Math 110. That student was very motivated and involved in the course.
* **89% of all students improved their midterm grades by the end of the semester**. Some of which, although in the minority, improved by 2 or more letter grades. Students after the first low grade on a quiz made significant adjustments in their study habits. The instructor provided them with a How to Study Guide and did more in-class examples for the students to work on.
* **Students need to strengthen their critical reading skills for word problems and also their analytical skills**. The weakest area for students was with word problems where they were required to read a scenario and determine what is being asked and how to select the variables. Also, if students were presented with a problem in a slightly different format they also became confused. Taking an exam online with multiple choice answers then having to take fill in the blank exams in-class was also a challenge.
* **MyStatLab and Statcrunch gave the students more opportunities to master the content.** Find more ways to tailor assignments and quizzes to meet the students’ needs. Continue utilizing this tool as a supplement to effective classroom instruction.
* **Students can continue to be challenged in course content.** Those students who have easily mastered certain course objectives should receive additional assignments or projects to continue to prepare them for real-world applications of statistics. At the same time more attention will be given to those course objectives with lower than average outcomes.

# INTRODUCTION

Three sections of Introduction to Statistics (Math 110.1, 110.4 and 110.5) were taught by a Mathematics Specialist during the Spring 2011 semester. This course was taught using content consistent with what was covered by the Math faculty in previous semesters. To further ensure standardization, the course objectives and text chosen by the Math department were adopted for this course. The major difference was in the use of on-line instructional tools (ebook included) that have been effectively used in the pre-foundation courses taught by other Mathematics Specialist. MyStatLab was selected as the web-based instructional tool for this course to help facilitate learning, provide instant student feedback and reinforce course content. Overall, the statistical content for this course was the same; however, the implementation of MyStatLab was new.

Each of the three sections of Math 110 had different student enrollment totals with a varying student class composition and Math background coming into the course. This resulted in slightly different outcomes. Therefore, the report will identify and summarize each section separately. An enrollment description for each of the three sections along with a brief class overview is summarized in the table below.

**Table 1. Summary Enrollment Totals for Math 110.1, Math 110.4 and Math 110.5**

|  |  |  |  |
| --- | --- | --- | --- |
| **Class Overview** | **Math 110.1** | **Math 110.4** | **Math 110.5** |
| Total Enrollment(At Time of Summary Attendance) | 30 | 20 | 28 |
| Withdrew | 1 | 1 | 3 |
| Abandon (Did not take final) | 0 | 0 | 0 |
| Total Enrollment(At Final Exam) | 29 | 19 | 25 |
| Attendance Summary (%) (Source: Moodle) | 84% | 88% | 87% |
| Time and Day of Class | T/TH10:30-11:45 | T/TH3:00-4:15 | M/W12:00-1:15 |

# PURPOSE

The purpose of this report is to provide a high level overview of the assessment of Introduction to Statistics (Math 110 sections 1, 4 and 5) given the introduction of MyStatLab as an integral part of the course. This course did not have specific chapter outcome metrics designed in the beginning of the semester nor measured throughout the course. However, any major observations on course content will be noted. Specific chapter/objective metrics will be developed and evaluated going forward. The scope of this report will be limited to evaluating overall grades and not chapter or course objective outcomes.

# MATH 110 COURSE DESCRIPTION AND OBJECTIVES

The course description and objectives remain consistent with Math faculty who have previously taught this course in the College of Arts and Science (CAS). The course description and objectives are clearly identified in the syllabus to set an expectation of what content will be covered in the course and what each student should be able to master by the end of the semester.

***Math 110 Course Description:*** This course provides an introduction to statistical concepts and methods. The main topics covered include descriptive statistics, probability theory and normal distributions.

***Math 110 Course Objectives:*** By the end of the course, students will be able to:

* Classify descriptive and inferential statistics,
* Distinguish between different types of variables and data,
* Summarize, organize, tabulate and graph statistical data,
* Find and analyze measures of center and variation of quantitative data,
* Apply the basic concepts of probability theory,
* Apply normal distributions in solving real-world problems involving percentages and percentiles,
* Demonstrate an operational knowledge of MyStatLab for statistical data analysis
* Metrics will be developed for the objectives listed above and measured in future courses.

# GOALS AND OBJECTIVES

Math 110 is not a pre-foundational; therefore, the assessment outcomes will significantly differ from those courses. For most students, this was their last Math requirement towards graduation. Therefore, they have been able to improve upon their study skills and benefit from 1-2 semesters of Math prior to enrolling in this course. Most students show up and complete their assignments. Therefore, the goals and objectives of this report will focus on identifying areas to improve the effectiveness of the course versus absenteeism and improving study skills.

# ASSESSMENT APPROACH

To ensure that the right resources are allocated to the areas having the most impact, the following assessment steps will be taken to gather data and provide meaningful and impactful recommendations.

1. ***Perform a grade analysis*** - Determine what components of the course are covered sufficiently enough by analyzing the grades and recording lessons learned. Also identify opportunities for improvement.

Evaluate the final grades– Look at those areas of the course that the students were able to master and continue to implement those strategies. Identify any differences between sections that future Math 110 classes can benefit from.

Set early expectations for excellence by improving midterm grades- Better prepare the students early in the semester for the rigor of the academic year. Compare midterm grades to final grades and explain the differences.

Identify grade variances and develop supplemental instruction- Support students who have a tendency to be less prepared or have a more difficult time grasping the material. Evaluate the performance of students by classification (Freshman, Sophomore, Junior and Senior). Also, look at Math 109 grades as an indication of preparedness for Math 110.

1. ***Determine correlation between attendance and performance*** - Improve early communication with students and their advisors for students who are absent. Identify correlations between attendance and grades. Also, note the benefit of MyStatLab for students who miss class due to extenuating circumstances.
2. ***Continue the utilization of MyStatLab/StatCrunch*** - Continue to identify ways to make MyStatLab more effective. Summarize the correlation between homework attempts, quiz and exam averages in MyStatLab. Continue to use StatCrunch in demonstrating real-world applications of statistics.

This assessment will help in the areas that enhance/support student learning and also those areas that need additional attention (lessons learned).

# Grade Analysis

The grade analysis was the first component of the course assessment to be evaluated. This requires a look at the components of the course that are outlined in the syllabus such as homework, quizzes, exams, finals and projects. However, a more detailed analysis will also be provided to look for trends and areas where resources can be allocated to improve performance outcomes. Therefore, the grade analysis will consist of the following components:

* Final Grade Analysis
* Comparison of Final Grades Between Sections (Math 110.1, Math 110.4 and Math 110.5)
* Midterm vs. Final Grade Comparison
* Comparison of Grades of Students by Class Designations - Freshmen (F), Sophomores (S), Juniors (J), Seniors (SR)
* Analysis of Each Grade Component
* Analysis of Preparedness for Math110: Evaluation of Pre-requisites

# *Final Grade Analysis*

Each of the three sections of Math 110 had impressive course averages of 84% for Math 110.1, 80% for Math 110.4 and 81% for Math 110.5. There are various factors that can be analyzed in searching for causality. Mathematics is reinforced through repetition and practice. The students had a homework assignment after each section (16 in total) as well as 4 statistical modeling projects for a total of 20 assignments. The Statcrunch projects challenged the students to utilize the theories they were learning in the text and also have seen in the homework assignments. The students saw the material in multiple representations which helped lead to a higher percent retaining and mastering the material. Also, a significant number of students were prepared coming into this course through highly effective instruction in prior courses.

For a more detailed assessment of the final grades, the following section will provide pie charts showing the percentage of students who earned a certain letter grade and in parentheses the number of students in each letter grade category.

***Math 110.1 - 93% of the students earned a C or better***. The hard work and commitment to the coursework was rewarded. There were 35% of the students who earned a B. Also, 7% who earned less than a C represented only 2 students out of 29 total. No student failed this course.

This particular section of Math 110 had an overall work ethic and commitment to the material that wasn’t seen consistently with other sections. This class could have been challenged more by evaluating the level of ease in completing the MyMathLab assignments or by administering a few more challenging exam questions. Although the overall final course average was only 3-4 percentage points higher than the next sections, the quiz averages were 9-10 percentage points higher. The pie chart in Figure 1 shows a distribution of grades and the relative frequency table is located in the Appendix.

**Figure 1. Math 110.1 Spring 2011 Final Grade Distribution**

***Math 110.4 - 79% of the students earned a C or better.*** Students in this late afternoon section had the lowest course average and enrollment of the three sections. Because it’s a small class of 19, the averages can be easily skewed by outliers and the grade distribution shown in the pie chart (for some grades) represent small numbers of students. For example, only 4 students earned less than a C out of a total of 19 students. Also, this class had the highest overall percentage (21%) of students below a C average among the 3 sections. Figure 2 shows the complete distribution of grades for Math 110.4.

**Figure 2. Math 110.4 Spring 2011 Final Grade Distribution**

***Math 110.5*** *-* ***88% of the students earned a C or better***. The highest percentage was 28% of the students earning a B. The 3 students earning less than a C represent 12% of the class enrollment. However, this class had the highest number of withdrawals of 3 students. At midterms those students weren’t passing the class and could have added to the count of students at risk of failing. Figure 3 below shows a complete distribution of grades for Math 110.5.

**Figure 3. Math 110.5 Final Letter Grade Distribution**

# *Comparison of Final Letter Grades Between Math 110 Sections (1, 4 and 5)*

Each of the three sections had different final grade averages with Math 110.1 having a higher final course grade average and also in each component of the course distribution.

The bar graph below shows the percentage of students earning letter grades for Math 110.1, Math 110.4 and Math 110.5. It shows that Math 110.1 had more A+, B+ and B’s and fewer grades lower than C than the other sections. For example, Math 110.1 had approximately 13% A’s versus Math 110.4 which had 10% A’s and Math 110.5 had 7.5% A’s. Figure 4 also shows that Math 110.1 had the highest level of B’s which was close to 35%. The course averages for sections Math 110.1, Math 110.4 and Math 110.5 were 84%, 80%, and 81% respectively. Although the final grades are close between the sections, class participation, preparedness and eagerness to learn were noticeably better in the Math 110.1 class. This was the earliest of the three sections (10:30am) and also had the most Freshmen. A detailed analysis of student classification and performance is described in later sections along with Math 109 grades.

**Figure 4. Math 110 Final Grade Comparison (Sections 1, 4 and 5)**

# *Midterm vs. Final Grade Comparison*

Approximately 67% of the course grade is earned after midterms. Therefore, the midterm is based upon limited information, but still gives the student a signal if they are headed in the right direction with plenty of opportunities to change their study habits if needed. By the time midterm grades were submitted, the student had completed 1 quiz and 1 exam along with 3-4 homework assignments. The average for Exam #1 was approximately 75% for all three sections with a large variance. This variance indicated that there was much room for improvement and the midterm grades reflected that.

Figure 5 shows for Math 110.1 that the percentage of students earning A’s and B’s totaled to 48% at midterms but drastically improved to 90% at finals. Also, there were no F’s in the final grades where as there were 2 during midterms.

**Figure 5. Math 110.1 Midterm Course Average vs. Final Course Average**

**Math 110.4 Midterm vs. Final Grade Comparison –** At midterm this section had approximately 5% of the students earning a course average of A then that doubled to over 10% at finals. Also, the number of students with at C- average at midterms was over 30% and that drastically declined to 5% with most of those students earning higher letter grades at finals. The number of A’s and B’s totaled to 37% at midterm; however, that increased to 65% for the final grade. See the Appendix for a detailed listing of each student’s midterm and final grade averages. See figure 6 below for a complete distribution of midterm and final grades.

**Figure 6. Math 110.4 Midterm Course Average vs. Final Course Average**

**Math 110.5 Midterm vs. Final Grade Comparison –** At midterm this section had approximately 4% of the students earning a course average of A then that doubled to over 8% at finals. The percentage of A’s and B’s totaled to 36% at midterms; however, improved to 60% during the finals. Also, the number of D’s and F’s totaled to 36% at midterms and drastically declined to 8% at finals. See the Appendix for a detailed listing of each student’s midterm and final grade averages.

**Figure 7. Math 110.5 Midterm Course Average vs. Final Course Average**

Overall, most students improved their study habits, were clear about the instructor’s expectations on the type of work required to be successful; therefore, they improved their grades significantly.

The improvements ranged from half a letter grade for a few students to more than 2 letter grades. The discipline of consistently doing the homework assignments and studying for exams and quizzes resulted in higher performance outcomes. As shown in table 2, 38% of students showed modest improvement in their grades less than 1 letter grade. However, 24% realized an improvement of greater than 1 letter grade but less than 2. Overall, most students improved in their performance. Table 2 summarizes the improvement made by all students in Math 110.1.

**Table 2. Math 110.1 Midterm to Final Grade Improvement Summary**

|  |  |  |
| --- | --- | --- |
| Number of Letter Grades Students Improved from Midterms to Final | Number of Students | Percent of Total Number of Students |
| 2 | 1 | 3% |
| 1 | 4 | 14% |
| Greater than 1 and Less than 2 | 5 | 17% |
| Greater than 0 Less than 1 | 11 | 38% |
| Greater than 1 Less than 2 | 7 | 24% |
| Less than 1 | 4 | 14% |

Over 40% of the students in Math110.4 experienced an increase in their midterm grades of up to 1 letter grade. Another 24% showed even more improvement to less than 2 letter grades. Two students’ grades remained the same and 1 student’s grade declined by 1 letter grade. It’s important to note that the two student’s grades that remained unchanged from midterm to finals were A’s and F’s. Those who put forth a consistent effort as a high achiever kept the same pace and the student who didn’t take advantage of all the resources in order to be successful continued down that path. The one student whose grades declined 1 letter grade went from a B to a C. This was also her second time taking the course. Table 3 summarizes the midterm to final grade improvement for Math 110.4.

**Table 3. Math 110.4 Midterm to Final Grade Improvement Summary**

|  |  |  |
| --- | --- | --- |
| Number of Letter Grades Students Improved from Midterms to Final | Number of Students | Percent of Total Number of Students |
| 2 | 1 | 3.4% |
| 1 | 3 | 10.3% |
| Greater than 1 and Less than 2 | 7 | 24.1% |
| Greater than 0 Less than 1 | 12 | 41.4% |
| 0 | 2 | 6.9% |
| -1 | 1 | 3.4% |

There were a total combined 64% of students in Math 110.5 who improved their midterm grade up to and including 1 letter grade. An additional 8% improved their grades to less than 2 letter grades. Those students whose grades remained the same earned A, A-, C+ and F. The same trend of the high achievers versus the students who did not change their study habits are the same as in the other Math 110.4 section. The one student whose grade declined went from a C to a D. Table 3 summarizes the improvement for the entire Math 110.5 class.

**Table 4. Math 110.5 Midterm to Final Grade Improvement Summary**

|  |  |  |
| --- | --- | --- |
| Number of Letter Grades Students Improved from Midterms to Final | Number of Students | Percent of Total Number of Students |
| Greater than 2 | 2 | 8% |
| 1 | 8 | 32% |
| Greater than 1 and Less than 2 | 2 | 8% |
| Greater than 0 Less than 1 | 8 | 32% |
| 0 | 4 | 16% |
| -1 | 1 | 4% |

The dedication to improving their performance and committing the time needed to master Statistics resulted in 89% (combined total) of the students in all 3 sections improving their grades.

# *Comparison of Student’s Grades by Class Designation*

Math 110 has a diverse student population depending upon when a student is eligible for or schedules this class. They could take the course as early as Freshmen year or as late as Senior year. This analysis will look at any trends by classification and determine if any resources need to be allocated to a certain group of students. Freshmen had the highest overall course grade average or the second highest average trailing the Juniors. Sophomores had the lowest grade averages in each of the 3 sections.

Table 5 shows a summary of the students by classification in Math 110.1. Freshmen which comprised 52% of the class had the second highest average of 85. This was a very strong Freshmen group that were prepared and it was evident in their grades.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  **Table 5. Summary of Final Course Grades for Math 110.1**

|  |  |  |  |
| --- | --- | --- | --- |
| Math 110.1 | Average Final Grade | Count | Percentage of Math 110.1 Students |
| Freshmen | 85 | 15 | 52% |
| Sophomore | 80 | 11 | 38% |
| Junior | 86 | 3 | 10% |
| Total | 84 | 29 | 100% |

|  |  |  |
| --- | --- | --- |
|  |  |  |
| Table 6 shows that there were students from every class in Math 110.4 with Freshmenrepresenting 32% and ranking first in their average followed by Seniors. Sophomores trailedthe other students. Seniors in Math 110.4 had a skewed average, because one of the 5 seniors had a 98% final grade. The Senior average without this outlier is 78%.  **Table 6. Summary of Final Course Grades for Math 110.4**

|  |  |  |  |
| --- | --- | --- | --- |
| Math 110.4 | Average Final Grade | Count | Percentage of Math 110.4 Students |
| Freshmen | 83 | 6 | 32% |
| Sophomore | 75 | 6 | 32% |
| Junior | 79 | 2 | 11% |
| Senior\* | 82/78\* | 5 | 26% |
| Total | 80 | 19 | 100% |

**\*Note: Senior average is reported with and without the outlier**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Math 110.5 didn’t have any Seniors in this class but the Juniors had the highest average of almost 88% followed by the Freshmen. Sophomores trailed the other students.  **Table 7. Summary of Final Course Grades for Math 110.5**

|  |  |  |  |
| --- | --- | --- | --- |
| Math 110.5 | Average Final Grade | Count | Percentage of Math 110.5 Students |
| Freshmen | 81 | 16 | 64% |
| Sophomore | 76 | 6 | 24% |
| Junior | 88 | 3 | 12% |
| Total | 81 | 25 | 100% |

 |  |  |

 |  |  |

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The trends for each of the classifications can be attributed to the following:

* Freshmen who tested into Math 109 their first semester then subsequently took Math 110 in the Spring have a strong Math background and highly effective instruction prior to taking this course.
* Sophomores tested into a pre-foundational Math course which may indicate why they may need additional support.
* Juniors accounted for most of the transfer students in each of the 3 sections. Therefore, they had taken their Math 109 equivalent and had to earned a C or better to have the credit transferred. This may indicate why they have such high averages. Further study is needed.

# *Analysis of Each Grade Component*

In order to determine where the students needed more help, progress with each assignment was evaluated and adjustments were made during the course of the semester. One considerable adjustment was to the number of attempts that each student had with their homework assignments. Having multiple attempts through the use of MyStatLab gave the students time to work on the concepts that were more challenging in an effort to master the material. This required that the students not give up when they didn’t answer the problem correctly and immediately work on a similar problem. The homework averages for all three sections were in the 90s. However, the first quiz averages were 75%. As a result of this considerably lower average than the first 5 homework assignments, the following adjustments were made:

* The homework attempts were limited in MyStatLab to 3.
* A How to Study sheet was given to the students
* More examples were worked out in the class by the instructor and the students

The students were asked where they were possibly having problems with the quiz that didn’t come up in the homework. The quiz was given in MyStatlab in the same format as the homework; however, they were limited to 1 attempt only. The quizzes were open resource as well. Many students indicated that they might not have put the time and effort into their homework, because they knew they had unlimited attempts. After the homework attempts were limited to 3, the homework averages went down slightly, but the second quiz average increased for Math 110.1, Math 110.4 and Math 110.5 by 11%, 7%, and 23% respectively. The students also began to “Ask the Instructor” and utilize the “Help Me Solve” functions more.

The exams were designed to be taken in-class and closed resource in order to test how much of the concepts the students have learned without the assistance of a computer or other resources. This was a bit of a transition, but it prepared them to master the material. The final exam was comprehensive but a formula sheet was allowed. So, the students’ comprehension of this material was tested in various formats. The homework and Statcrunch (survey included) averages were the highest with the quizzes and exams almost averaging the same with the exception of Math 110.1 which had a higher average. The following table summarizes the course components.

**Table 8. Course Summary by Grade Component**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Math 110.1** | **Math 110.4** | **Math 110.5** |
| Homework/Statcrunch | 92% | 84% | 90% |
| Quizzes | 84% | 75% | 74% |
| Exams | 76% | 75% | 75% |
| Final | 81% | 78% | 77% |
| Survey | 93% | 91% | 94% |
| Attendance | 84% | 88% | 87% |
| Course Total | 84% | 80% | 81% |

Homework and Statcrunch assignments (including survey) were the strongest areas for the students as reflected in the course summary table 8. In the future, more time will be devoted to test preparation which touches on critical reading and analytical skills.

# *Analysis of Preparedness for Math 110: Evaluation of Pre-requisites*

Looking at the outcomes of the pre-requisite Math classes in further detail can give more in-depth overview of what is happening especially for those students who needed additional support. For each class, a detailed summary of each student’s Math grades is provided in the appendix. However, the focus of this analysis will be on those students whose final grades are C and below in Math 109 or prerequisite course.

Table 9 provides a summary of Math 109 final grade versus Math 110 for section 1. The following key points were taken from that table:

* + 5 students earned a C or below in the pre-requisite course
	+ 2 students improved their grade to B or B-
	+ 1 student improved her grade from D to D+
	+ 1 student dropped a letter grade from C to D
	+ 1 stayed the same at C

Forty percent of the students in this category improved their grade from Math 109 to Math 110; however, 60% remained in this category. This is a significant number who may not be as prepared for Math 110 and need additional support or not be ready to take the course

**Table 9. Math 110.1: Comparison of Math 109 or Math 123 versus Math 110 (Pre-requisite grades on C+ or below only)**

|  |  |
| --- | --- |
| Pre-requisite Math 109/ Math 123\* Grade | Math 110.1 Final Grade |
| C | 2 students earned a B-1 student earned a D1 student earned a C after repeat NP first time |
| D | 1student earned a D+ |

Table 10 provides a summary of Math 109 or Pre-requisite final grade versus Math 110 for section 4. The following key points were taken from that table:

* + 6 students earned a C or below in the pre-requisite course
	+ 1 student improved her grade from a C to a C+
	+ 2 students remained the same at C and D+
	+ 1 student made a drastic improvement from D+ to A-
	+ 1 students went from D to F
	+ 1 student improved from D to C- but will still have to retake course for a 3rd time

One student in this category made a drastic improvement from D+ to A; however, 50% are at risk for staying at or below a C average. This is a significant percentage who are at risk of not improving their Math grades from the pre-requisite course.

**Table 10. Math 110.4: Comparison of Math 109 versus Math 110 (Pre-requisite grades C or below only)**

|  |  |
| --- | --- |
| Pre-requisite Math 109 Grade | Math 110.4 Final Grade |
| C (1 student took Math123) | 1 student earned a C+ |
| C- | 1student earned a D+ |
| D+ | 1 student earned a D+1 student earned a A- |
| D | 1 students earned a F1 student earned a C- (will repeat course 2nd time) |

Table 11 provides a summary of Math 109 or Math 123 final grade versus Math 110 for section 5. The following key points were taken from that table:

* 8 students earned a C or below in the pre-requisite course.
* 3 students improved their grades to a C+
* 1 student improved to a B
* 1 student earning a D+ improved slightly to a C-
* 1 student earning a D remained at a D
* 1 student earned a D improved to a C
* 1 student earning a C- improved to a C

In Math 110.5, 50% made improvements in their grades to a C+ or B average in Math 110. However, 50% remained in the C or less category. The student whose grade remained at a D was a Freshman. The one student who failed the course was a transfer student; therefore, no prior grades were provided. Table 11 provides a detail of the comparison between courses.

**Table 11. Math 110.5: Comparison of Math 109 or Math 123 versus Math 110 (Pre-requisite grades on C or below only)**

|  |  |
| --- | --- |
| Pre-requisite Math 109 or 123\* Grade | Math 110.5 Final Grade |
| C (1 student took Math123) | 2 students earned a C+1 student earned a C,1 student earned a B |
| C- | 1student earned a C+1 student earned a C |
| D+ | 1 student earned a C- |
| D | 1 student earned a D |

Note: 1 student earned an F in Math 110, but was a transfer student and her prior Math grades aren’t recorded.

# Attendance Summary

Attendance is the second component of the outcome assessment. Attendance has a direct correlation to a student’s overall performance. Having the benefit of an instructor explaining the material, answering questions, student interaction and working out problems on the board helps reinforce learning. The overall class attendance rates for each of the 3 sections ranged from 84%-88%. This high attendance rate indicates that the students understood the correlation and took advantage of in-class instruction.

The following summary table provides the final grades of students whose attendance rates were 75% or less.

**Table 12. Final Grades of Students With Attendance Rates of 75% or Less**

|  |  |
| --- | --- |
| **Final Grade Earned** | **Percent of Students Whose Attendance was 75% or Less** |
| **Math 110.1** | **Math 110.4** | **Math 110.5** |
| B | 14% | 0% | 0% |
| B- | 3% | 0% | 0% |
| C+ | 0% | 0% | 0% |
| C | 0% | 5% | 8% |
| D+ | 3% | 5% | 0% |
| D | 3% | 0% | 4% |
| F | 0% | 0% | 4% |

What is interesting is the fact that 14% of students in Math 110.1 earned a B average with this attendance rate. Here is a list of possible reasons:

* + ***Determination despite extenuating circumstances***. A couple of those students had deaths in their families and were determined to still keep up with the work despite extenuating circumstances. However, not all students were capable of doing so. There were two students in the Math 110.4 class that missed classes due to extenuating circumstances earned C- and a D+.
	+ ***MyStatLab (a web-based application) for their assignments and quizzes***. Once they completed an assignment it was graded online and they were able to use the study plan to improve upon areas that they were the weakest in. MyStatLab also has a “Help Me Solve Function” and “Ask Instructor” function. The “Ask Instructor” function would allow them to send the instructor an email with their questions and have them answered remotely.
	+ ***Moodle provided links to powerpoint presentations of each day’s lecture***. Also included were due dates of assignments as reminders of what was contained in the syllabus.

Although in-class attendance is extremely important, for situations where the student is committed technology and instructor support allows them the opportunity to still keep up with the work.

# MYSTATLAB and STATCRUNCH

MyStatLab is the third component of the outcome assessment. MyStatLab is a software educational tool from the suite of products developed by Pearson. It is very similar in functionality and user interfaces to MyMathLab. This product has been used by instructors in the Pre-Foundational and General Education classes and was adopted for the first time for Math 110 during the Spring 2011 semester. The goal was to leverage the technology to assist students in mastering the course material through study plans, online homework assessments and other instructional aides. Also, for the first time in this course, the students weren’t required to buy a book. The ebook was embedded into the software.

The students utilized the study plans which provided additional chapter problems not included in the assigned homework. They also took advantage of the “Help Me Solve” and “Ask the Instructor” functions in MyStatLab. This allowed them to continue to work the problem with assistance without giving up on the questions that were more challenging. Also, the homework settings allowed the student to continue to practice the problems. The advantage of this application of MyStatLab is allowing the students to receive instant feedback without waiting for the instructor to manually grade and return the homework assignments timely enough so the students make improvements. Instructor comments to each question were provided to the student online via MyStatLab.

The following summarizes a few observations regarding the use of the MyStatLab:

* The majority of the students utilized the ebook in MyStatLab; however, those who wanted a text were able to borrow or purchase one.
* For first time users, there wasn’t much of a learning curve.
* The number of attempts on homework assignments were initially unlimited but after the first quiz grade were limited to 3. This motivated the students to put the effort in to answer the question correctly on the 1st time without guessing.
* The online quizzes which were developed in the same format as the homework assignments were also easy for the students to navigate.
* The “Ask Instructor” function allowed the student to send the instructor a question in the middle of a homework problem and the question would be linked to the instructor’s email. If the instructor is online, the student could receive an immediate response.
* The “Help Me Solve” function assisted the students in working out their homework problems by prompting the students to answer each step of a multi-step problem.
* The instructor monitored each homework assignment and could go in and see what problems each student missed and email the student with suggestions on where they went wrong. This was all done within the software.
* The instructor also could go into homework assignments and quizzes and give partial credit given the handwritten work they were required to turn in with the quizzes. Also, the students were required to keep homework notebooks.
* There were software glitches that were brought to the attention of the developer.
* The Statcrunch assignments were engaging and the students were very creative in designing their surveys.

# SUMMARY OF ANALYSIS AND OBSERVATIONS

Math 110 (Sections 1, 4 and 5) were analyzed to determine how well the students performed in these three sections and if there are some lessons learned to be implemented going forward. It appears that looking at the data, the students were overall very successful. They covered the course content of 5 chapters as outlined in the syllabus. The students had 20 assignments utilizing 2 different software packages, 3 quizzes, 2 in-class exams, 1 final and 1 survey. The students rose to the occasion and most sought help when they needed assistance.

The beginning of the semester was a bit of an adjustment period for students who weren’t sure what to expect and also getting accustomed to a new professor and for some new software. After the midterm grades, the students understood what it would take to be successful. The following are key observations:

* The students in each of the 3 sections were overall very successful with final section averages of 80% or above.
* There was a high completion rate of homework assignments and StatCrunch assignments. They also scored high on those that were completed.
* The students enjoyed using the software applicatons especially the StatCrunch assignments.
* The unlimited attempts at homework assignments earlier in the semester didn’t necessarily help improve the mastery of the course content. Some students guessed until they go the correct answer. Limiting the attempts to 3 was a reasonable number that resulted in better quiz averages.
* Some students were challenged by seeing the same question in a slightly different format. This was the case for word problems. They may need more help in critical reading and analytical reasoning.
* Each of the 3 sections had various strengths and weaknesses. Math 110.1 had a significantly higher quiz average and slightly higher course average. This section had a different commitment to the course content.
* Freshmen students had a high overall final average grade. Only in 1 section did the Juniors have better overall grade averages than the Freshmen. The Freshmen had strong Math backgrounds. There were a few that didn’t do so well and those Freshmen had Math 109 grades of C+ or less.
* Sophomores were the lowest performing students in each section on average.
* The quiz and exam grades for the final chapter covered (chapter 6 Normal Distributions) were lower than the earlier chapters. This could be the result of end of the semester crunch with a project and other class assignments/projects.
* The students worked well in groups on their end of semester surveys. The students used Statcrunch to develop a survey based upon their majors, received responses via the web, collected and analyzed the responses and also document findings all within Statcrunch. The students were able to create real world applications of statistical concepts through this one tool.
* Students had a strong background in calculating the mean, median and identifying the mode. Also, they were strong in bar graphs and pie charts.

# RECOMMENDATIONS

In order to continue experiencing these performance outcomes and also building upon the progress made, the following recommendations are made:

* Continue using MyStatLab with the ebook component. This tool is invaluable to the student’s success, because it gives them an added resource to support their mastery of the course material. Also, continue using the ebook only. It was effective and also those students who wanted a hard copy textbook will borrow or buy a used one.
* Identify those students who earned a C or below in Math 109 and provide additional support. Monitor their homework grades, encourage them to use the study plan in MyStatlab, and also encourage them to get a tutor and use office hours.
* Students earning a D or D+ in Math 109 should consult with a counselor before registering for this course especially first year freshmen. Their success rates aren’t that high.
* Spend more time on the beginning chapters by doing additional in-class examples. Make the transition more smooth which should be reflected in higher midterm grades.
* Do a few MyStatlab problems in-class that are similar to the homework assignments.
* Spend more time on Chapters 6 (Normal Distribution) by giving more examples in class and also giving more homework problems for this chapter.
* Continue to set a culture of high academic excellence that is expected for all students.
* Provide Sophomores more support similar to that described for the Math 109 students earning a C+ or below.
* Continue to monitor homework and quiz averages and offer comments via the email component of MyStatlab.

**APPENDIX**

**Math 110.1 Course Grade Summary**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student ID | CLASS | DA | HW  | Quiz  |  | Exam | Final | Survey | Course | Midterm | Final |
| 1 | F | 100 | 100 | 96 |  | 80 | 84 | 100 | 90 | B- | A- |
| 2 | S | 100 | 100 | 95 |  | 80 | 84 | 100 | 90 | B+ | A- |
| 3 | F | 98 | 100 | 88 |  | 74 | 77 | 88 | 84 | C- | B |
| 4 | F | 96 | 95 | 83 |  | 79 | 90 | 85 | 86 | C | B+ |
| 5 | S | 94 | 99 | 86 |  | 64 | 88 | 88 | 83 | D+ | B |
| 6 | F | 92 | 100 | 87 |  | 83 | 85 | 90 | 89 | C+ | A- |
| 7 | S | 92 | 80 | 73 |  | 77 | 89 | 90 | 81 | C | B |
| 8 | F | 92 | 98 | 87 |  | 74 | 79 | 100 | 85 | C- | B+ |
| 9 | S | 92 | 78 | 89 |  | 86 | 86 | 100 | 86 | A | B+ |
| 10 | F | 90 | 99 | 91 |  | 95 | 99 | 100 | 96 | B+ | A |
| 11 | F | 90 | 100 | 83 |  | 69 | 81 | 85 | 82 | C+ | B |
| 12 | JR | 90 | 100 | 87 |  | 78 | 73 | 90 | 84 | B+ | B |
| 13 | S | 90 | 83 | 91 |  | 75 | 72 | 90 | 81 | B- | B- |
| 14 | S | 90 | 93 | 73 |  | 59 | 48 | 100 | 71 | F | C |
| 15 | JR | 88 | 100 | 94 |  | 90 | 87 | 100 | 93 | A- | A |
| 16 | F | 88 | 95 | 74 |  | 74 | 78 | 85 | 81 | C- | B- |
| 17 | F | 83 | 100 | 89 |  | 90 | 99 | 100 | 94 | A- | A |
| 18 | S | 83 | 100 | 93 |  | 90 | 95 | 100 | 94 | A | A |
| 19 | JR | 83 | 98 | 80 |  | 73 | 68 | 100 | 81 | C- | B |
| 20 | S | 81 | 92 | 81 |  | 82 | 92 | 90 | 87 | B | B+ |
| 21 | F | 79 | 98 | 90 |  | 78 | 85 | 88 | 86 | B | B+ |
| 22 | F | 77 | 87 | 84 |  | 64 | 83 | 100 | 80 | C | B- |
| 23 | F | 75 | 77 | 74 |  | 83 | 70 | 100 | 79 | B+ | B- |
| 24 | S | 73 | 65 | 66 |  | 49 | 52 | 90 | 60 | F | D |
| 25 | F | 69 | 88 | 87 |  | 82 | 72 | 88 | 82 | B+ | B |
| 26 | S | 67 | 67 | 48 |  | 72 | 58 | 88 | 66 | C- | D+ |
| 27 | F | 65 | 94 | 80 |  | 76 | 91 | 100 | 85 | C+ | B |
| 28 | F | 65 | 95 | 87 |  | 78 | 80 | 90 | 84 | B+ | B |
| 29 | S | 56 | 95 | 91 |  | 68 | 93 | 85 | 83 | C+ | B |
|  | **Average** | **84** | **92** | **84** |  | **76** | **81** | **93** | **84** |  |  |

Key

Class: Each student’s class designation – Freshmen (F), Sophomores (S), Junior (JR), Senior (SR)

DA: Daily Attendance Average

HW: Homework and Statcrunch Assignments Average

Quiz: Average of 3 Quiz Grades

Exam: Average of 2 Exams

Final: Final Exam Grade

Survey: Survey Grade

**Math 110.4 Course Grade Summary**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student ID | CLASS | DA |  | HW | Quiz | Exam | Final | Survey | Course | Midterm | Final |
| 1 | SR | 100 |  | 96 | 82 | 73 | 71 | 93 | 82 | C- | B |
| 2 | F | 98 |  | 99 | 93 | 83 | 95 | 93 | 92 | A- | A |
| 3 | S | 98 |  | 96 | 91 | 87 | 88 | 95 | 91 | B | A- |
| 4 | S | 98 |  | 98 | 84 | 72 | 73 | 95 | 83 | C- | B |
| 5 | SR | 98 |  | 100 | 98 | 96 | 96 | 95 | 97 | A | A |
| 6 | SR | 96 |  | 97 | 89 | 64 | 67 | 95 | 79 | C | B- |
| 7 | F | 93 |  | 70 | 88 | 89 | 94 | 80 | 85 | B+ | B+ |
| 8 | S | 90 |  | 95 | 89 | 84 | 91 | 80 | 89 | B- | A- |
| 9 | JR | 89 |  | 76 | 74 | 77 | 69 | 100 | 78 | C- | C+ |
| 10 | F | 85 |  | 97 | 87 | 84 | 88 | 95 | 89 | C+ | A- |
| 11 | F | 85 |  | 99 | 77 | 79 | 90 | 80 | 85 | C- | B+ |
| 12 | JR | 85 |  | 84 | 87 | 75 | 75 | 100 | 82 | B- | B |
| 13 | S | 85 |  | 43 | 33 | 50 | 44 | 80 | 50 | F | F |
| 14 | SR | 85 |  | 94 | 86 | 68 | 69 | 95 | 80 | C- | B- |
| 15 | F | 81 |  | 64 | 65 | 75 | 92 | 95 | 77 | D+ | C+ |
| 16 | SR | 81 |  | 76 | 66 | 59 | 67 | 95 | 70 | C- | C- |
| 17 | F | 78 |  | 71 | 20 | 73 | 72 | 100 | 67 | D | D+ |
| 18 | S | 74 |  | 77 | 51 | 61 | 65 | 95 | 68 | D | D+ |
| 19 | S | 67 |  | 70 | 69 | 78 | 75 | 75 | 73 | B | C |
| **Average** |  | **88** |  | **84** | **75** | **75** | **78** | **91** | **80** |  |  |

Key

Class: Each student’s class designation – Freshmen (F), Sophomores (S), Junior (JR), Senior (SR)

DA: Daily Attendance Average

HW: Homework and Statcrunch Assignments Average

Quiz: Average of 3 Quiz Grades

Exam: Average of 2 Exams

Final: Final Exam Grade

Survey: Survey Grade

Midterm: Midterm Letter Grade

Final: Final Course Letter Grade

**Math 110.5 Course Grade Summary**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student ID | CLASS | DA | HW |  | Quiz | Exam | Final | Final | Survey | Course | Midterm | Final |
| 1 | F | 100 | 87 |  | 78 | 77 |  | 89 | 95 | 84 | C- | B |
| 2 | JR | 100 | 100 |  | 93 | 98 |  | 100 | 100 | 98 | A | A |
| 3 | S | 100 | 98 |  | 91 | 84 |  | 85 | 100 | 91 | A- | A- |
| 4 | S | 100 | 100 |  | 84 | 68 |  | 67 | 100 | 81 | C | B |
| 5 | F | 98 | 100 |  | 87 | 84 |  | 84 | 95 | 89 | B- | A- |
| 6 | F | 96 | 98 |  | 90 | 79 |  | 88 | 100 | 89 | B- | A- |
| 7 | F | 96 | 94 |  | 94 | 85 |  | 83 | 95 | 89 | B | A- |
| 8 | F | 96 | 100 |  | 87 | 80 |  | 83 | 95 | 88 | B- | B+ |
| 9 | F | 96 | 89 |  | 76 | 80 |  | 85 | 100 | 85 | B- | B |
| 10 | F | 96 | 100 |  | 85 | 76 |  | 71 | 100 | 84 | C | B |
| 11 | S | 94 | 91 |  | 68 | 64 |  | 59 | 100 | 74 | D+ | C |
| 12 | F | 92 | 100 |  | 91 | 89 |  | 89 | 100 | 93 | A- | A |
| 13 | F | 92 | 97 |  | 53 | 87 |  | 84 | 100 | 85 | B- | B |
| 14 | JR | 92 | 100 |  | 69 | 70 |  | 91 | 100 | 84 | F | B |
| 15 | F | 90 | 95 |  | 73 | 59 |  | 69 | 100 | 76 | F | C+ |
| 16 | F | 88 | 91 |  | 65 | 63 |  | 78 | 95 | 76 | D+ | C+ |
| 17 | F | 88 | 59 |  | 66 | 73 |  | 59 | 100 | 70 | D | C- |
| 18 | S | 88 | 89 |  | 61 | 73 |  | 72 | 100 | 78 | D+ | C+ |
| 19 | F | 79 | 95 |  | 81 | 71 |  | 70 | 90 | 79 | C- | B- |
| 20 | F | 73 | 91 |  | 61 | 64 |  | 58 | 100 | 72 | D+ | C |
| 21 | F | 71 | 71 |  | 73 | 71 |  | 76 | 100 | 75 | D | C |
| 22 | S | 71 | 58 |  | 45 | 62 |  | 68 | 0 | 54 | F | F |
| 23 | S | 67 | 91 |  | 51 | 76 |  | 78 | 100 | 78 | C+ | C+ |
| 24 | F | 63 | 62 |  | 48 | 64 |  | 63 | 75 | 62 | C | D |
| 25 | JR | 63 | 98 |  | 72 | 76 |  | 83 | 100 | 83 | C+ | B |
|  | **Average** | **87** | **90** |  | **74** | **75** |  | **77** | **94** | **81** |  |  |

Key

Class: Each student’s class designation – Freshmen (F), Sophomores (S), Junior (JR), Senior (SR)

DA: Daily Attendance Average

HW: Homework and Statcrunch Assignments Average

Quiz: Average of 3 Quiz Grades

Exam: Average of 2 Exams

Final: Final Exam Grade

Survey: Survey Grade

Midterm: Midterm Letter Grade

Final: Final Course Letter Grade

**Frequency table results for Math110.1 – Final Course Grade**

|  |  |  |  |
| --- | --- | --- | --- |
| **Math110.1** | **Frequency** | **Relative Frequency** | **Percent** |
| A | 4 | 0.1379 | 14% |
| A- | 3 | 0.1034 | 10% |
| B | 10 | 0.3448 | 35% |
| B+ | 5 | 0.1724 | 17% |
| B- | 4 | 0.1379 | 14% |
| C | 1 | 0.0344 | 3% |
| D | 1 | 0.0344 | 3% |
| D+ | 1 | 0.0344 | 3% |

**Frequency table results for Math110.4 – Final Course Grade**

|  |  |  |  |
| --- | --- | --- | --- |
| **Math110.4** | **Frequency** | **Relative Frequency** | **Percent** |
| A | 2 | 0.11 | 11% |
| A- | 3 | 0.16 | 16% |
| B | 3 | 0.16 | 16% |
| B+ | 2 | 0.11 | 11% |
| B- | 2 | 0.11 | 11% |
| C | 1 | 0.05 | 5% |
| C+ | 2 | 0.11 | 11% |
| C- | 1 | 0.05 | 5% |
| D+ | 2 | 0.11 | 11% |
| F | 1 | 0.05 | 5% |

**Frequency table results for Math110.5 – Final Course Grade**

|  |  |  |  |
| --- | --- | --- | --- |
| **Math110.5** | **Frequency** | **Relative Frequency** | **Percent** |
| A | 2 | 0.08 | 8% |
| A- | 4 | 0.16 | 16% |
| B | 7 | 0.28 | 28% |
| B+ | 1 | 0.04 | 4% |
| B- | 1 | 0.04 | 4% |
| C | 3 | 0.12 | 12% |
| C+ | 4 | 0.16 | 16% |
| C- | 1 | 0.04 | 4% |
| D | 1 | 0.04 | 4% |
| F | 1 | 0.04 | 4% |