



# Trinity

## EXECUTIVE SUMMARY

### Most important findings

- Pass rates ranged between 66-78% during Fall 2013 and Spring 2014
- Pass rates for repeaters range between 51-61%
- There is a strong and positive relationship between excellent attendance and student course averages
- Lab for Math 101 assists students in earning better grades
- For Math 108 in particular, hours logged into the MML study plan were strongly correlated with high grades
- AA/GENSTU, COMM, GENSTU, HUMR, and SOCCJ majors fail math courses at rates that are disproportionate to their enrollment size
- Successful students go to class
- Transfer students are twice as likely as first time students to get A's in their math course
- Students mathematical strengths lie in showing how problems are solved, interpretation, representation, and getting answers
- Students mathematical weaknesses lie in areas of communication, application, and evaluation

### Overview of the most important recommendations

- Math 100 needs a supplemental lab
- Create a mathematical support group specifically for repeaters that targets study skills and mathematical reinforcement
- Provide successful mentors for COMM, GENSTU, HUMR, SOCCJ, and undecided majors and create support groups specific to these majors
- Add supplemental labs to math courses for AA/GENSTU students at THEARC
- Conduct studies on the mathematical preparation of transfer students
- Conduct more studies on mathematical preparation and mathematics self-efficacy of PNUR majors
- Embed more activities that require students to eloquently define problems, communicate their thought process in writing, and give students hands on experience with evaluating their processes.

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## **Introduction**

This report will provide a comprehensive overview of findings for 22 (1 of which is a CAS Math 108 course taken by 2 SPS students) courses taught by mathematics teaching faculty across the Fall of 2013 and Spring 2014 semesters. In previous reports, data was included for each individual course for each semester. After careful consideration, it was determined that this report would focus less on individual instructor's course outcomes and take a holistic approach of identifying trends across all courses, identifying strengths and challenges using one representative sample, and offering recommendations. More specifically, it will discuss general information for 4 sections of Math 100, 1 section of Math 030, 3 sections of Math 101S, 2 sections of Math 060, 5 sections of Math 108, 6 sections of Math 110, and 1 section of Math 112. The primary sources of data used in this report are student data from Power Campus, course statistics calculated by Moodle, and rubric data.

### ***Profile of SPS students***

School of Professional Studies math learners are students who typically enter Trinity not having taken a mathematics course in 5-10 years or more. These students tend to carry more anxieties and phobias surrounding mathematics than College of Arts of Sciences students (CAS) (many of whom have just matriculated from high school and recently completed Algebra I or II), and thus require specialized attention. Some of these students were registered with Disabilities services and received accommodations. Demographically, the majority of students were of African/African American descent, female, older adults, and juggling responsibilities of family, full time employment, and school.

### ***Math course descriptions***

Math 030/100, Introduction to Pre-Algebra is designed for students with little or no high school algebra, or those who have not taken high school algebra in a number of years (030 is taught at THEARC). It provides a comprehensive overview of basic computational skills and their applications, such as fractions, decimals, ratios and proportions, percentages, measurement, and an introduction to algebra.

Math 060/101S, Introductory Algebra, is a course intended to provide students with an intensive review of high school algebra (060 is taught at THEARC). Topics include a review of basic arithmetic operations, the real number system, algebraic expression and exponents with basic rules of algebra, linear equations and inequalities with applications, and graphs of equations and inequalities. The S in Math 101S indicates that this course is paired with a 2 hour block of supplementary lab time. During lab, students took

opportunities to gain clarity on certain topics, engage in group activity, and become more proficient through extensive practice problems.

Math 108/112, Foundations of Mathematics, is a non-traditional, application-driven course that focuses on teaching students how to think critically with numerical or mathematical information (112 is taught at THEARC). The course is designed to teach quantitative reasoning by emphasizing topics, both useful and relevant to a liberal arts program, and that enable students to become quantitatively literate. These mathematical topics include the concepts of logic, set theory, reasoning, real numbers, the metric system, linear equations and inequalities, and systems of equation.

Math 110- Statistics, is designed to introduces the fundamental statistical methods. Topics include: descriptive analysis and presentation of single-variable data, probability theory, random variables, the binomial distribution, the normal distribution, and sample variability. Statistical software, SPSS, is an integral part of the course.

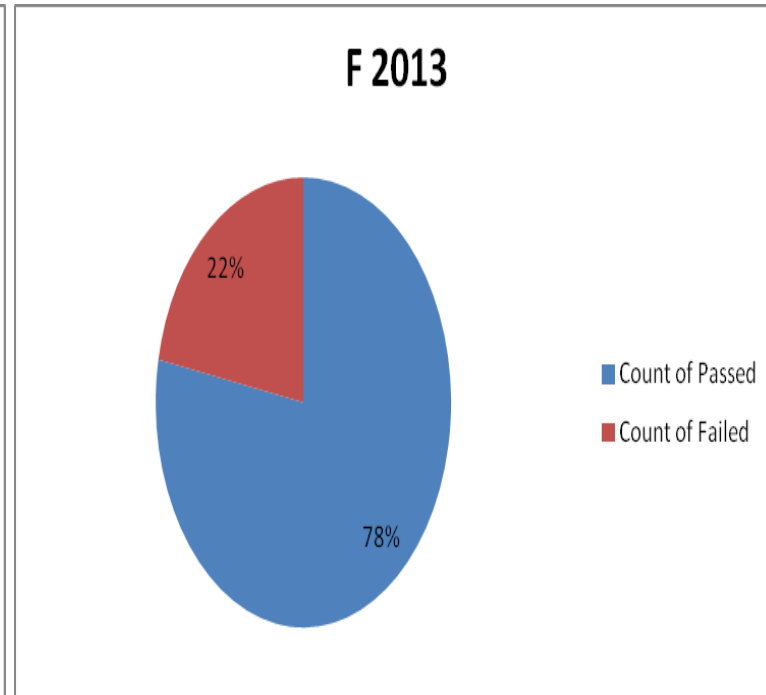
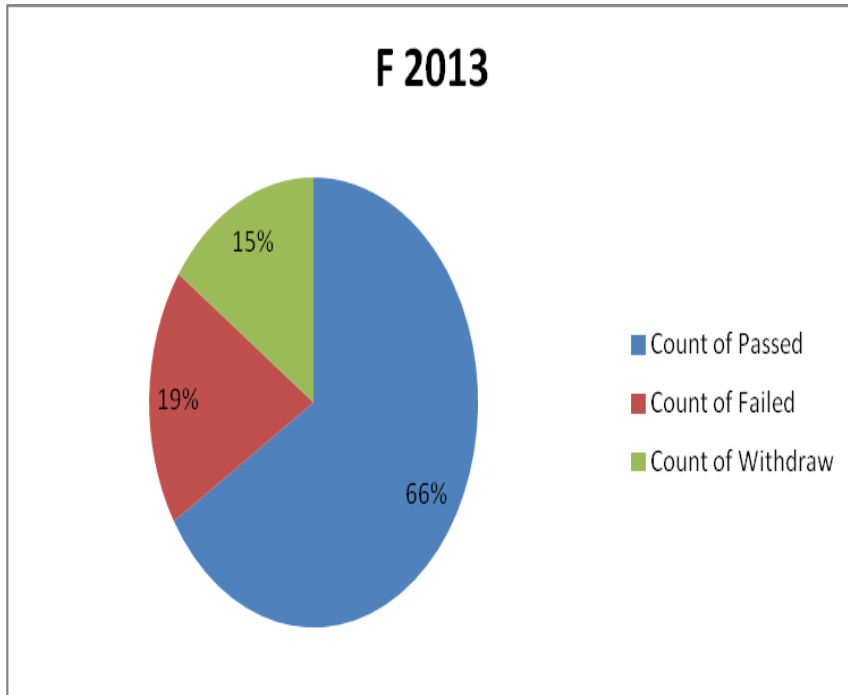
## Overall data analysis

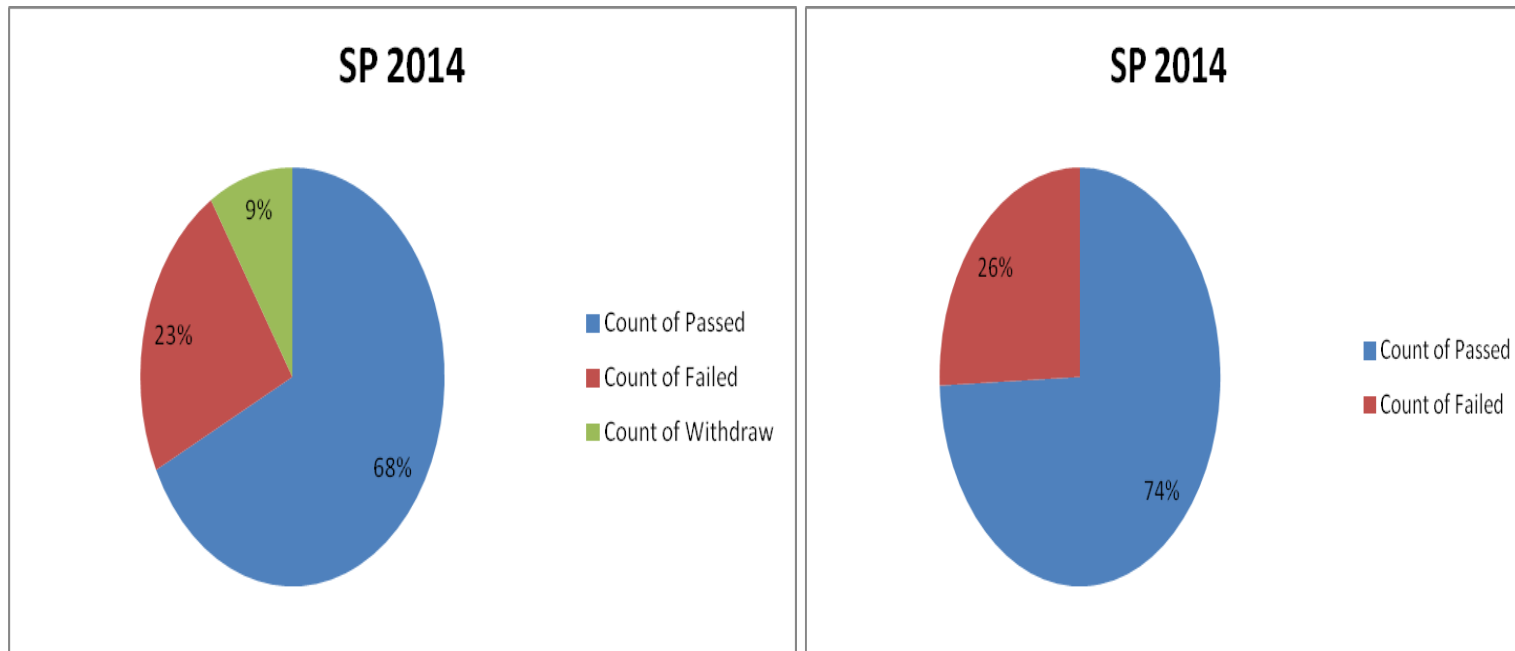
Data from the Fall of 2013 and the Spring of 2014 were collected and analyzed for all mathematics courses. Below is an overall summary of data for both semesters.

Semester	Count of Student Enrolled	Count of Passed	Count of Failed	Count of Withdraw
F 2013	182	121	34	28
SP 2014	167	113	39	15
<b>Grand Total</b>	349	234	73	43

CAS students taking SPS courses were not included in the data. From the summary, data for 182 students School of Professional Studies taking a mathematics course in the Fall and 167 students in the Spring was obtained, for a total of 349 data entries (**Note:** some of the students in the Fall were also taking courses in the Spring, so all 349 entries are not unique). There were higher numbers

of students enrolled in a mathematics course in the Fall than Spring semester. In the graphs below, pass rates are illustrated by semester for all enrolled, and then for those who did not withdraw.



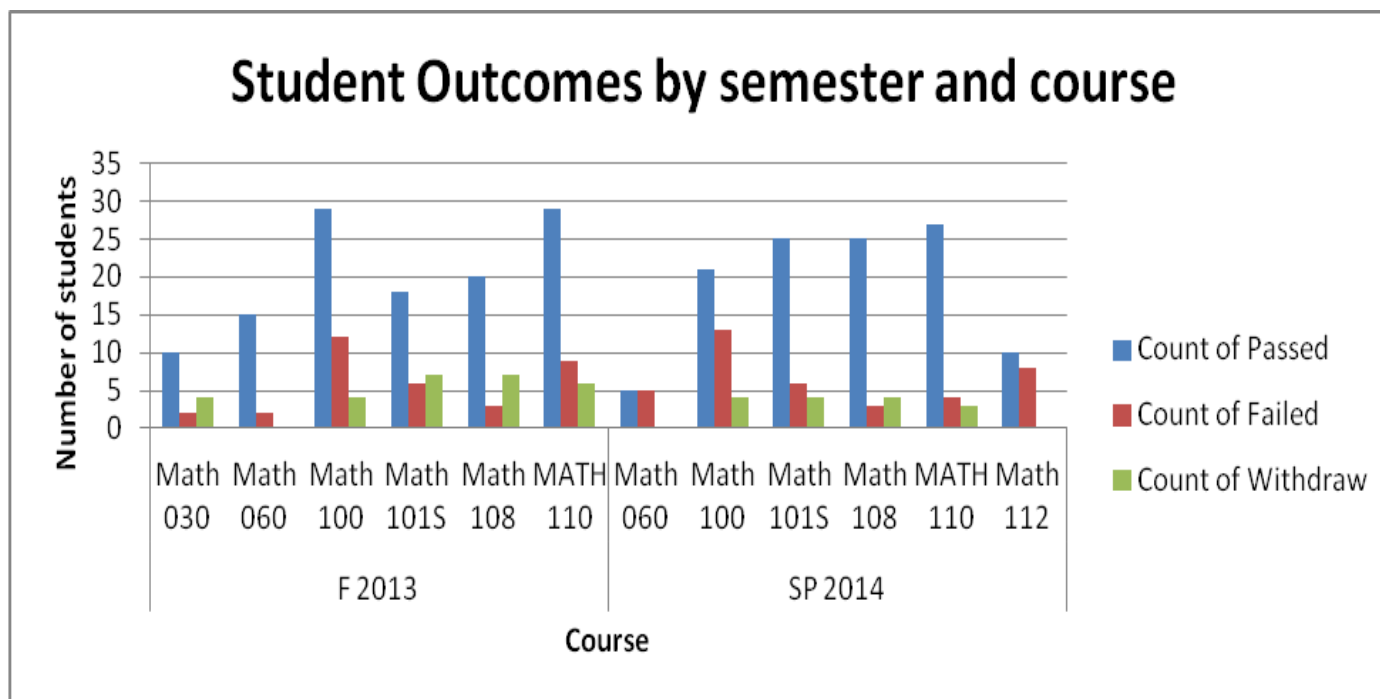


Overall pass rates across all courses for each semester ranged between 66- 78 %, a fairly impressive pass rate for this population. The data is fairly consistent from semester to semester with more than half of all students enrolled passing their mathematics course, about one fourth of students failing and between 9- 15% of students withdrawing.

In the next section, enrollment is broken down by mathematics course for each semester.

<b>Semester</b>	<b>Course</b>	<b>Total</b>
<b>F 2013</b>	Math 030	16
	Math 060	17
	Math 100	45
	Math 101S	30
	Math 108	30
	MATH 110	44
	F 2013 Total	182
<b>SP 2014</b>	Math 060	10
	Math 100	38
	Math 101S	35
	Math 108	32
	MATH 110	34
	Math 112	18
	SP 2014 Total	167
<b>Grand Total</b>		<b>349</b>

In both the Fall 2013 and Spring 2014, Math 100 had the highest enrollment. The graph below illustrates the numbers of students who passed, failed, and withdrew by semester and course.

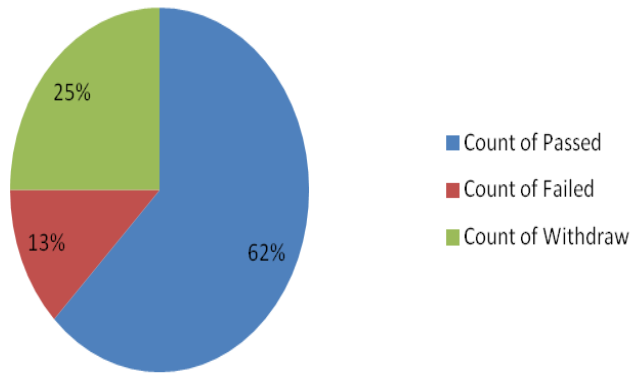


During the Fall 2013, the highest numbers of students passing and failing occur in Math 100 and 110. No students withdrew from Math 060. During the Spring, the numbers of students passing were high all around, with the numbers of students passing and failing being similar for both Math 060, Math 100, and Math 112. No students withdrew from Math 060 or Math 112. In both semesters, it appears that students struggle with Math 100, and Math 112 for the Spring.

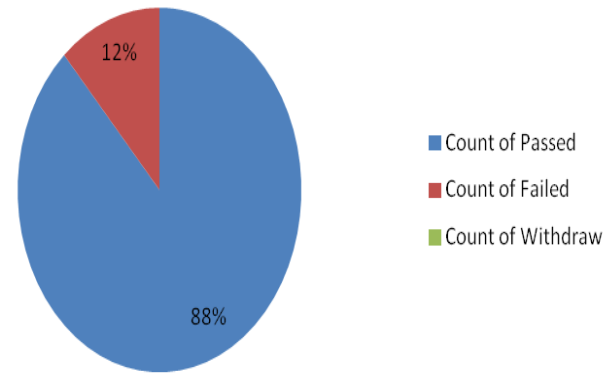
Pass rates are broken down by course for each semester in the following graphs.



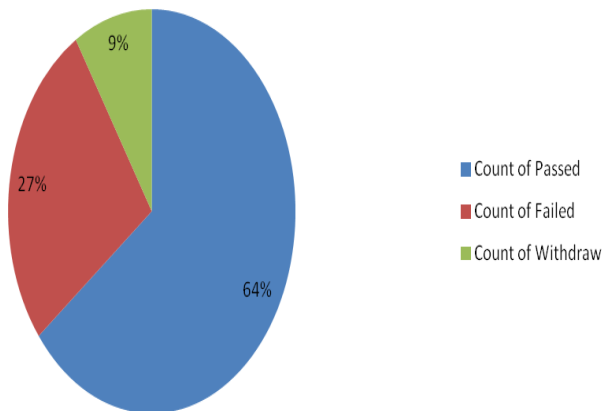
**F 2013 - Math 030**



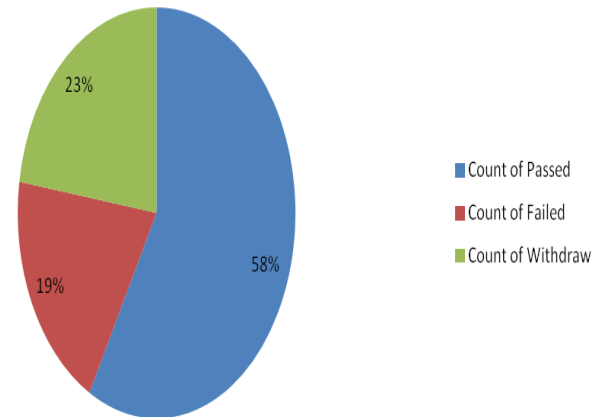
**F 2013 - Math 060**

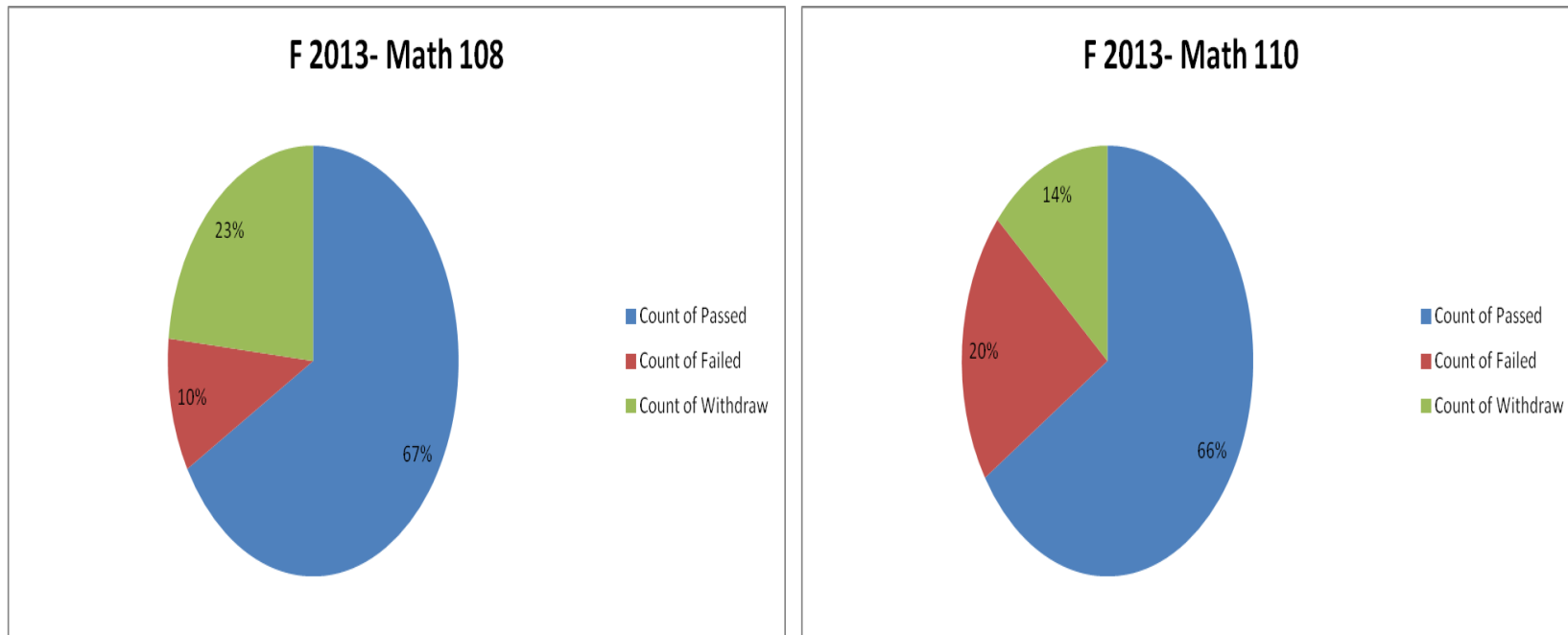


**F 2013- Math 100**



**F 2013- Math 101S**

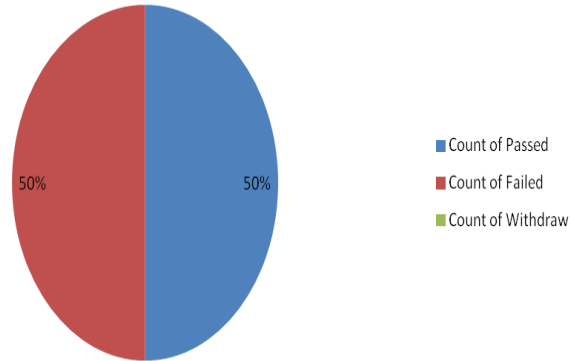




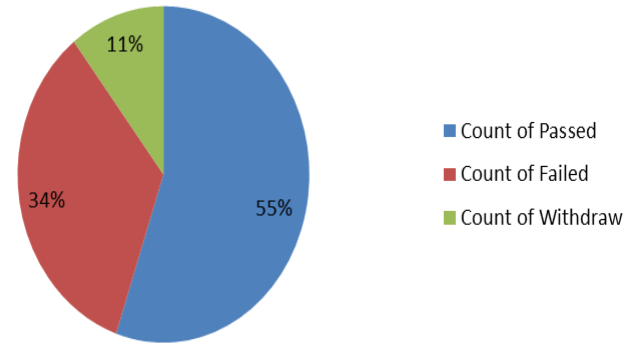
From these graphs, almost all courses had pass rates in the 60% except Math 101S and Math 060. Math 060 had the highest pass rate of 88%. Math 100 had the highest rate of failure, 27%. Withdrawal rates for highest for Math 030, Math 101S, and Math 108, and lowest for Math 100. less than 10%.

Pass rates are broken down by course in the following graphs for Spring 2014.

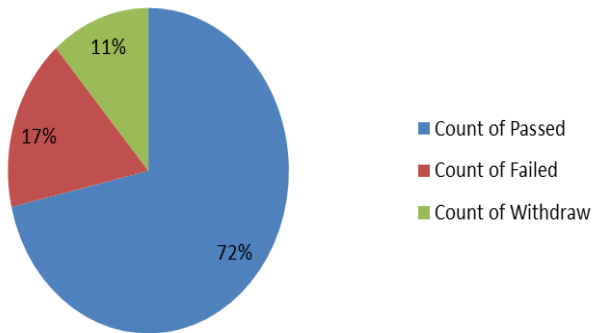
**SP 2014- Math 060**



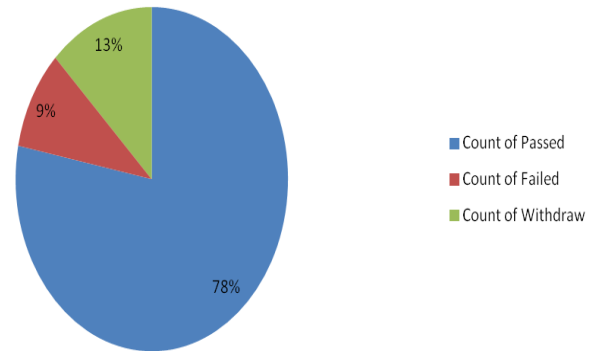
**SP 2014 - Math 100**

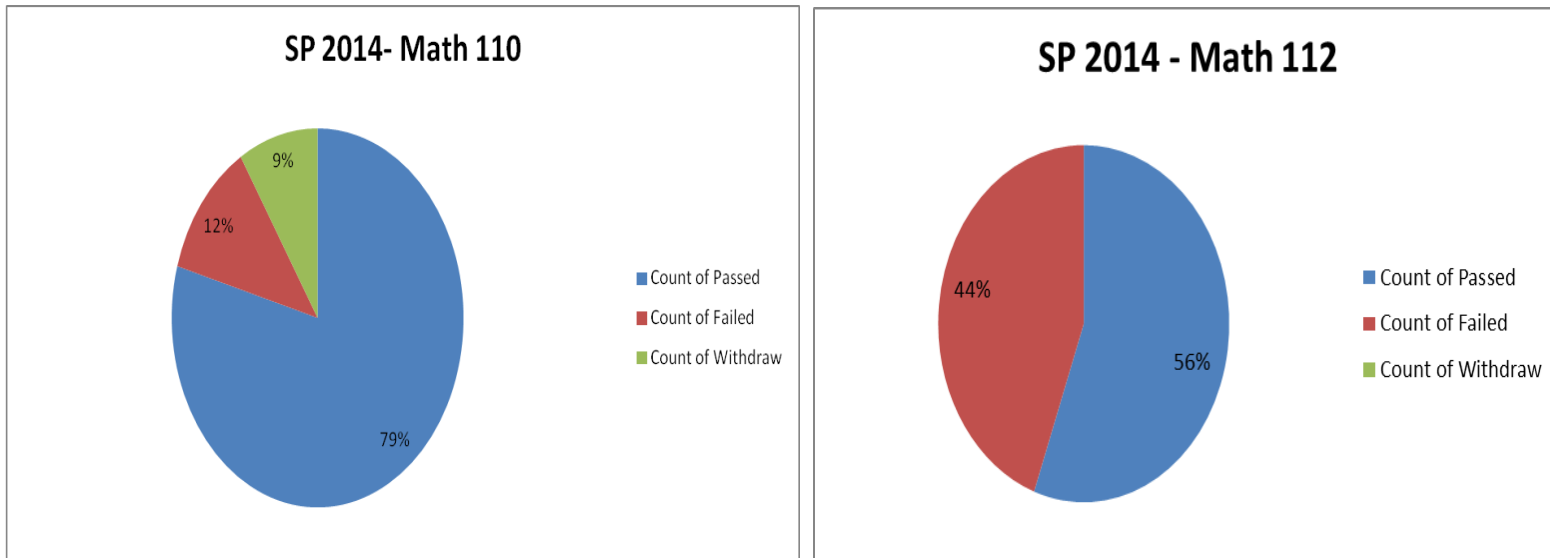


**SP 2014 - Math 101S**



**SP 2014- Math 108**





From the Spring 2014 data, pass rates were highest for Math 110 and Math 108 and exceeded 70%. This is excellent. Failure rates were highest for Math 060 and Math 112. Withdrawal rates were highest for Math 108 and Math 100, and low all across the board. Math 060 and Math 112 had no withdrawals.

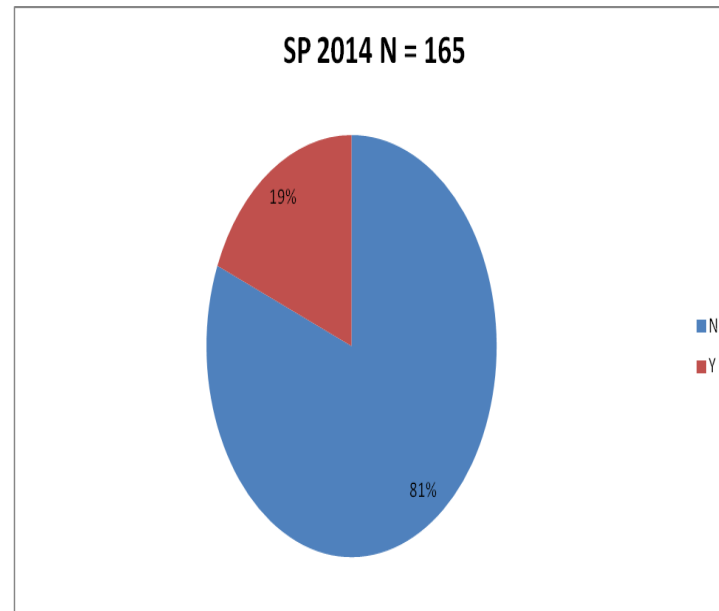
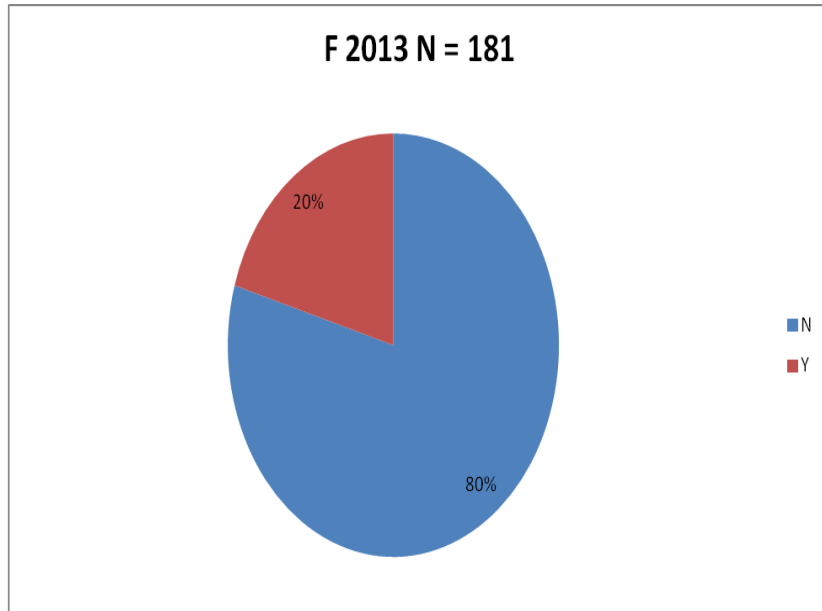
## Repeaters

Below is a summary of the number of students repeating a mathematics course by semester and course and whether the student passed, failed, or withdrew. It is important to note that students taking Math 101S who were repeating Math 101 were not described as such in the University's data system, and thus the Math 101S repeat numbers only reflect students who were repeating the actual Math 101S as opposed to 101 and 101S courses.

Semester	Course	Count of Repeating	Count of Passed	Count of Failed	Count of Withdraw
<b>F 2013</b>	<b>Math 030</b>	5	2		3
	<b>Math 060</b>	2	2		
	<b>Math 100</b>	10	5	4	1
	<b>Math 101S</b>	6	4	1	1
	<b>Math 108</b>	4	2		2
	<b>Math 110</b>	9	4	1	4
<b>F 2013 Total</b>		36	19	6	11
<b>SP 2014</b>	<b>Math 060</b>	1	1		
	<b>Math 100</b>	8	3	4	1
	<b>Math 101S</b>	3	2	1	
	<b>Math 108</b>	6	4	1	1
	<b>Math 110</b>	13	9	2	2
<b>SP 2014 Total</b>		31	19	8	4
<b>Grand Total</b>		67	38	14	15

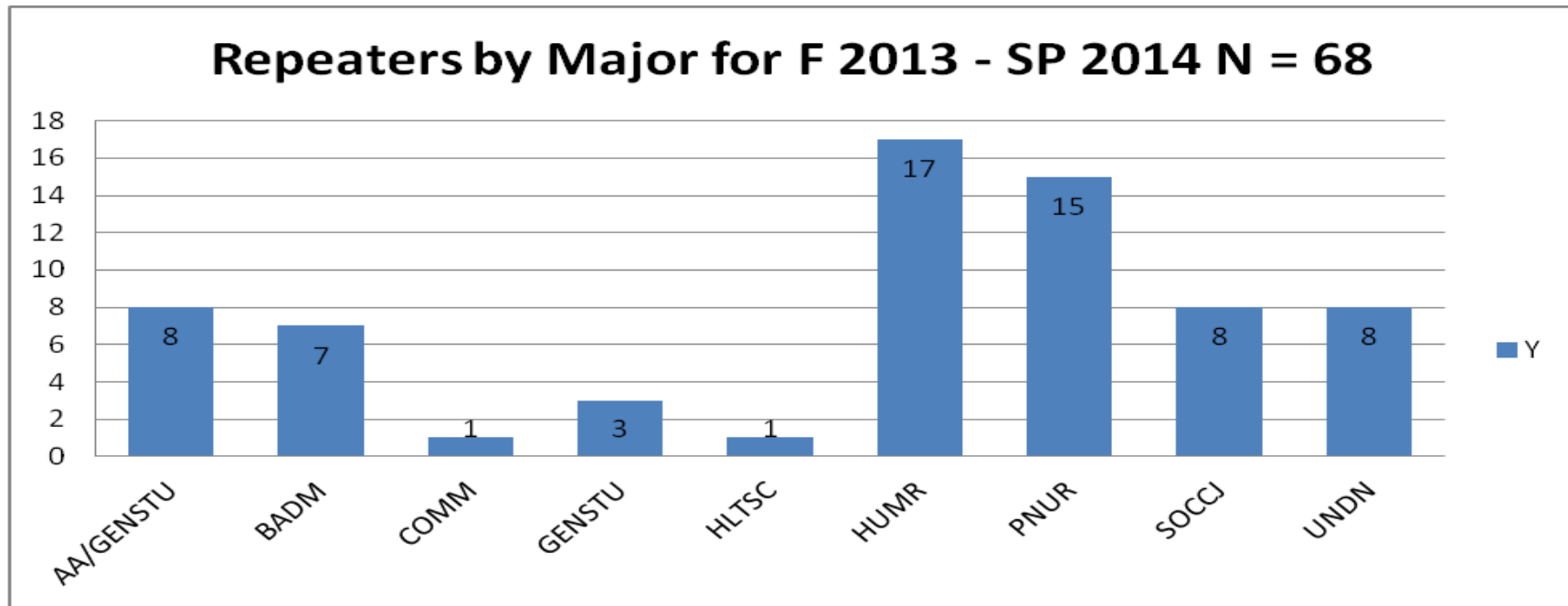
During the Fall 2013 and Spring 2014 semesters, Math 100 and Math 110 had the highest number of repeaters. The number of repeaters is lowest for Math 060. The number of repeaters is slightly higher during the Fall than during the Spring. What the data shows consistently is that during both semesters Math 100 and its equivalent at THEARC presents the greatest challenge for repeaters.

Below is a visual representation of repeaters in relation to all students registered for a math course for each semester. N represents students who are not repeating and Y represents students who are repeating.



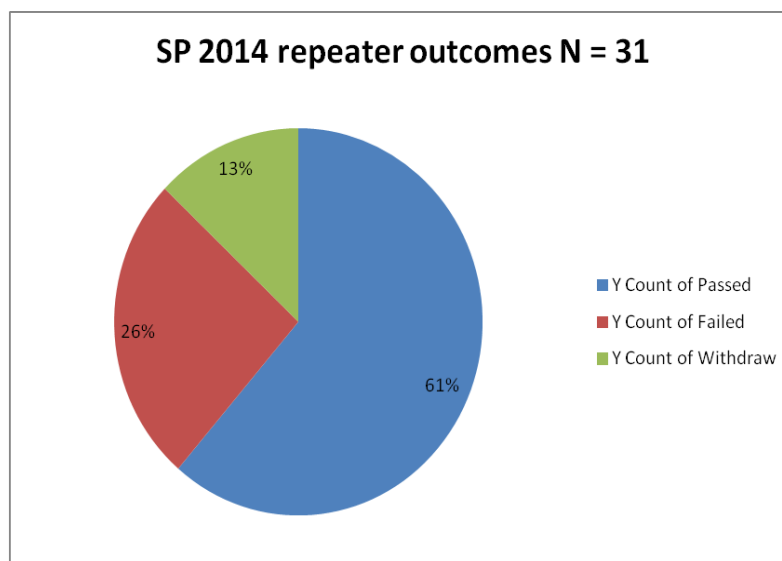
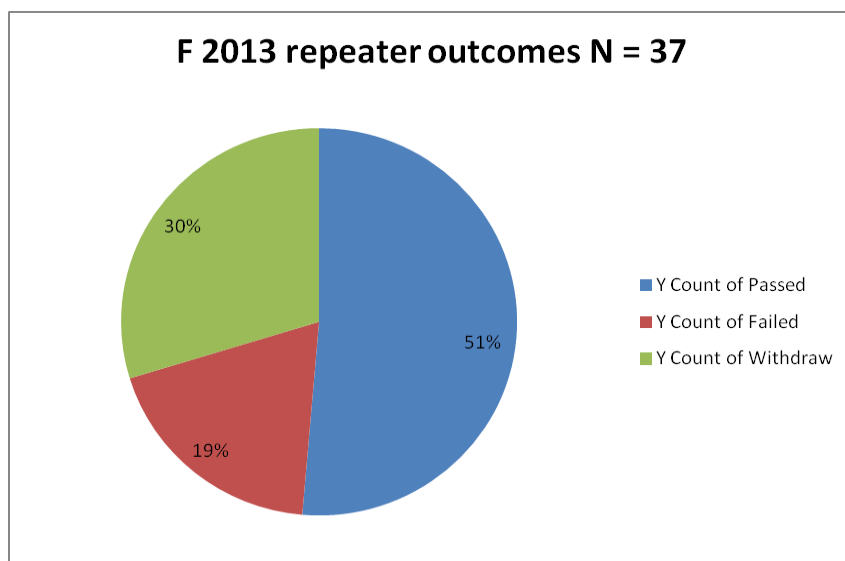
For 3 students it was unknown as to whether they were repeating or not and are not included in the above graphs. All three students were majoring in some type of nursing degree. Approximately 20% of students were repeating during both semesters.

The representation below shows repeaters broken down by major across all courses and both semesters.



HUMR and PNUR majors had the largest number of repeaters with COMM and HLTSC having the lowest numbers.

Below is an illustration of how repeaters fared in the courses during Fall 2013 and Spring 2014.



49% of students during the Fall semester, either withdrew or failed as compared to 39% in the Spring. Students fared better in the Spring with 61% of all repeaters passing their course.

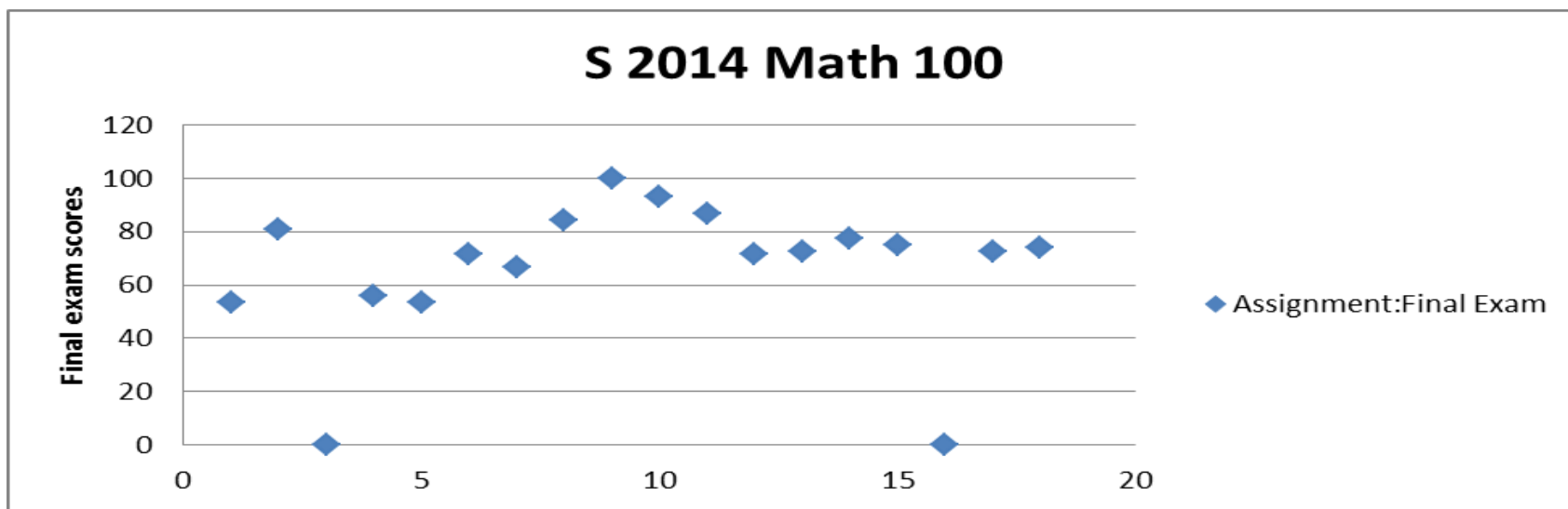
### Micro-analysis of students’ strengths and weaknesses

#### ***Math 100***

An analysis of the mathematics specialist’s Spring 2014 Math 100 class (which is being used as a representative sample of the total Math 100 population) shows the various areas that students excel in along with where they need more support. Students excelled in Chapter 1 and had difficulties in Chapters 2-4. Chapter 1 covered whole numbers while Chapters 2-4 covered integer and fraction operations.

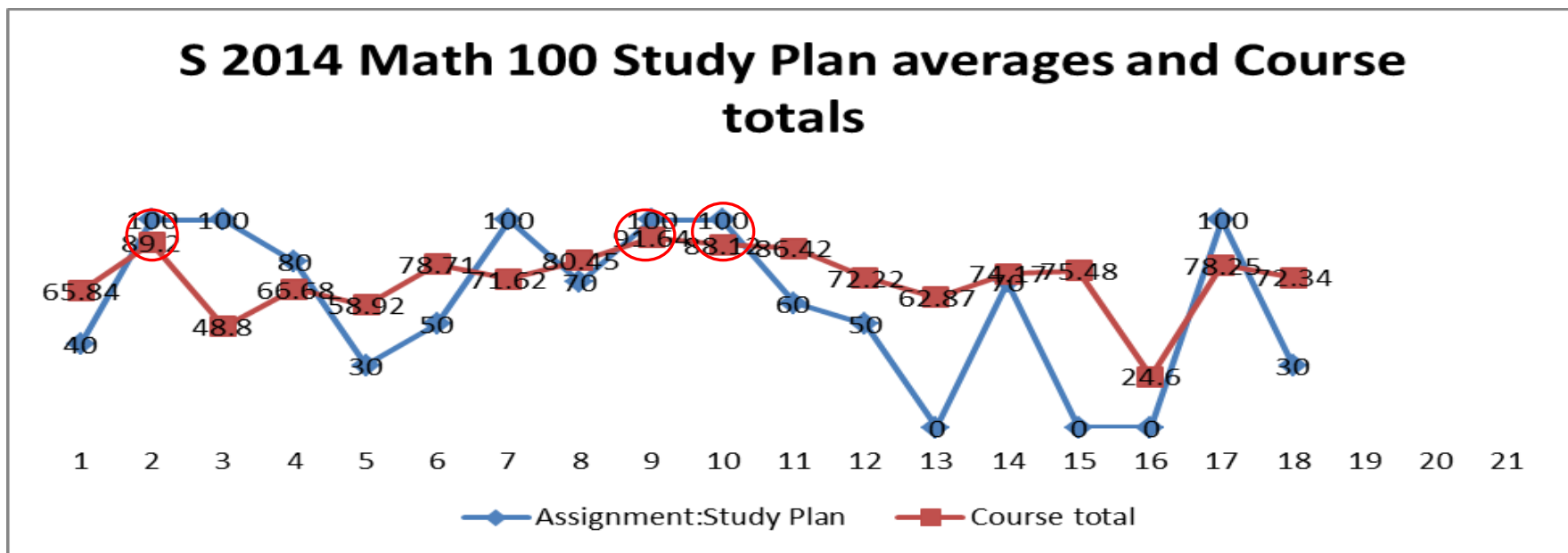
The distribution of Final exam scores is shown below.





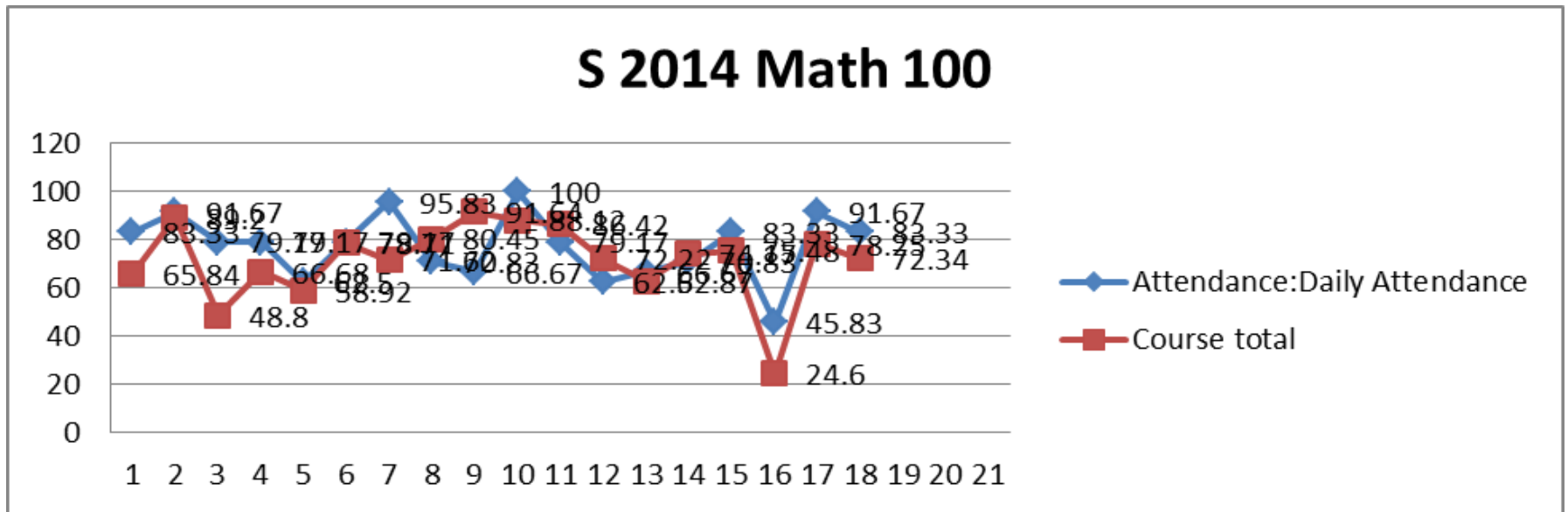
Twelve students scored a 70% or higher on the Final exam while 4 students scored below. Two did not take the Final as indicated by the dots on 0.

In the graph below, the relationships between students’ study plan averages and their overall course averages are explored. Study plan averages were based on the number of hours students logged into the study plan in the MyMathLab learning management system. The study plan was mandatory for this course.



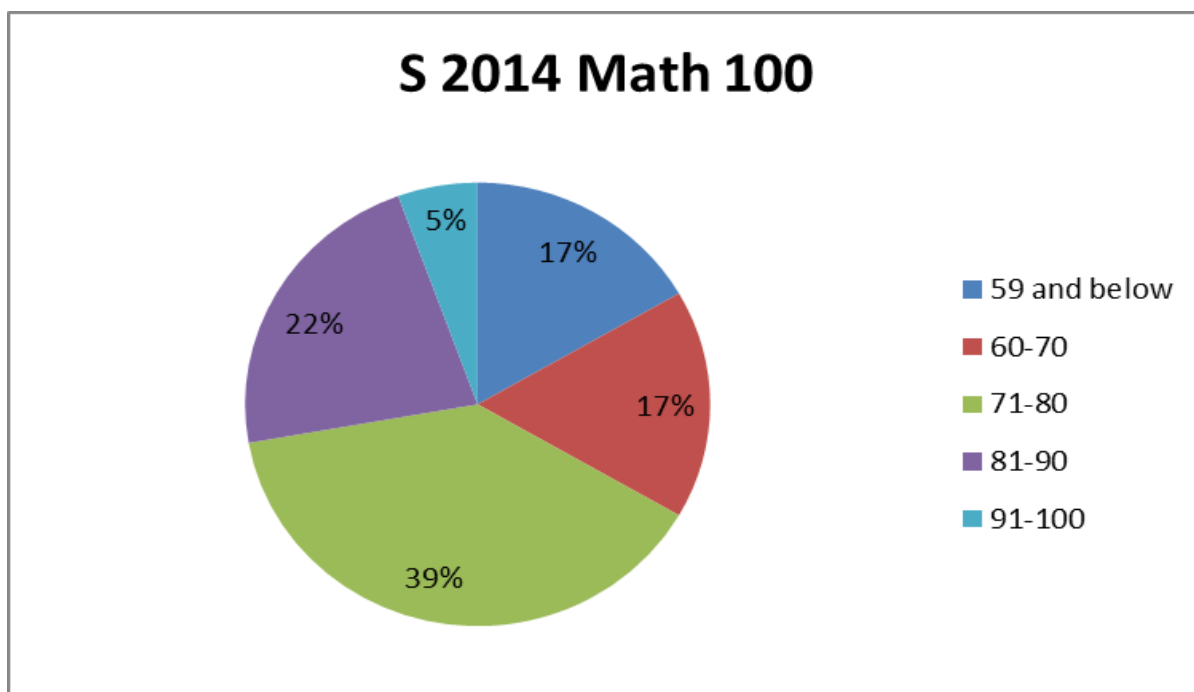
When looking at the above data, all students with course averages of 85% or higher, also had study plan averages of 100%. Thus it can be stated that students who spend more time in the study plan, will do better exceptionally well in the course. Students with low overall course averages tended to have lower overall course averages.

Findings on attendance rates and course averages are shown below.



Attendance and course average rates were close for most students. Students with low attendance rates tended to have lower course averages and students with higher attendance rates had higher course averages.

Overall course averages are shown below.

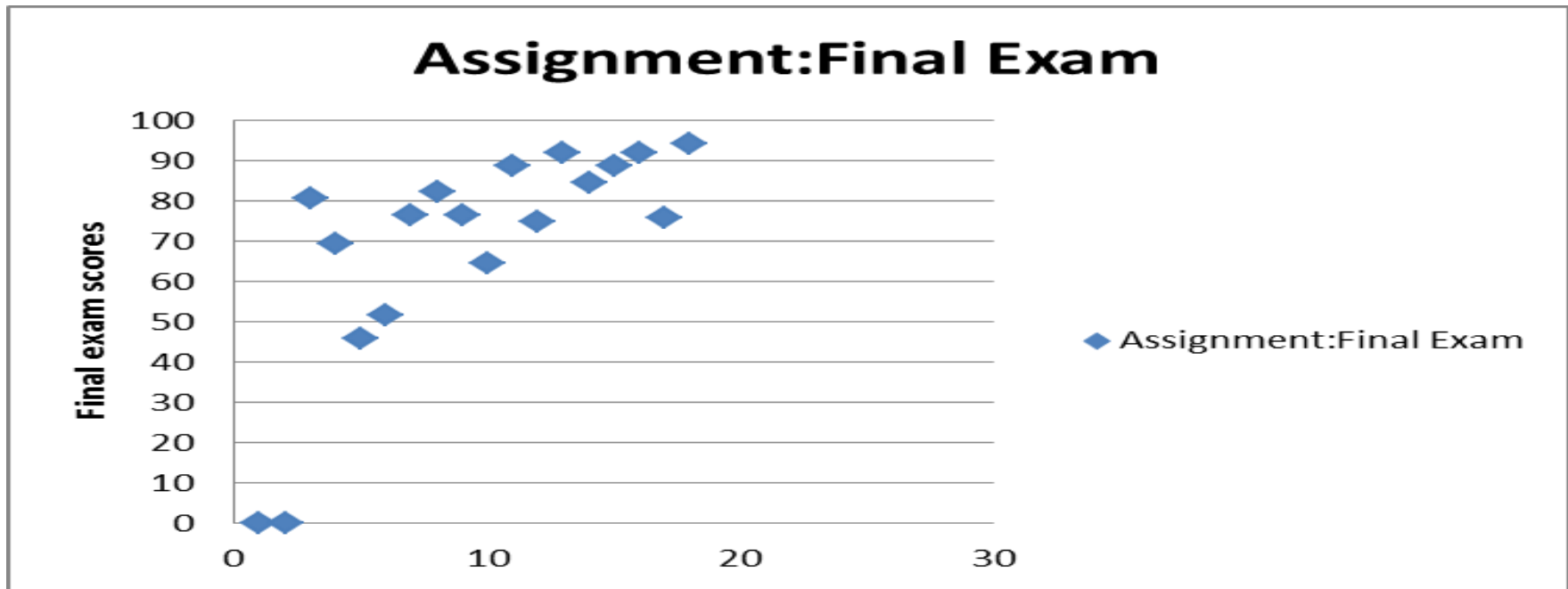


66% of students passed the course with a score above 70%. This course posed difficulty for students. The challenges can be remedied with the offering of a Math 100 Lab (which is currently in the works). During this lab, the extra much needed time can be devoted to strengthening skills with addition and subtraction of integers and fractions.

### ***Math 101S***

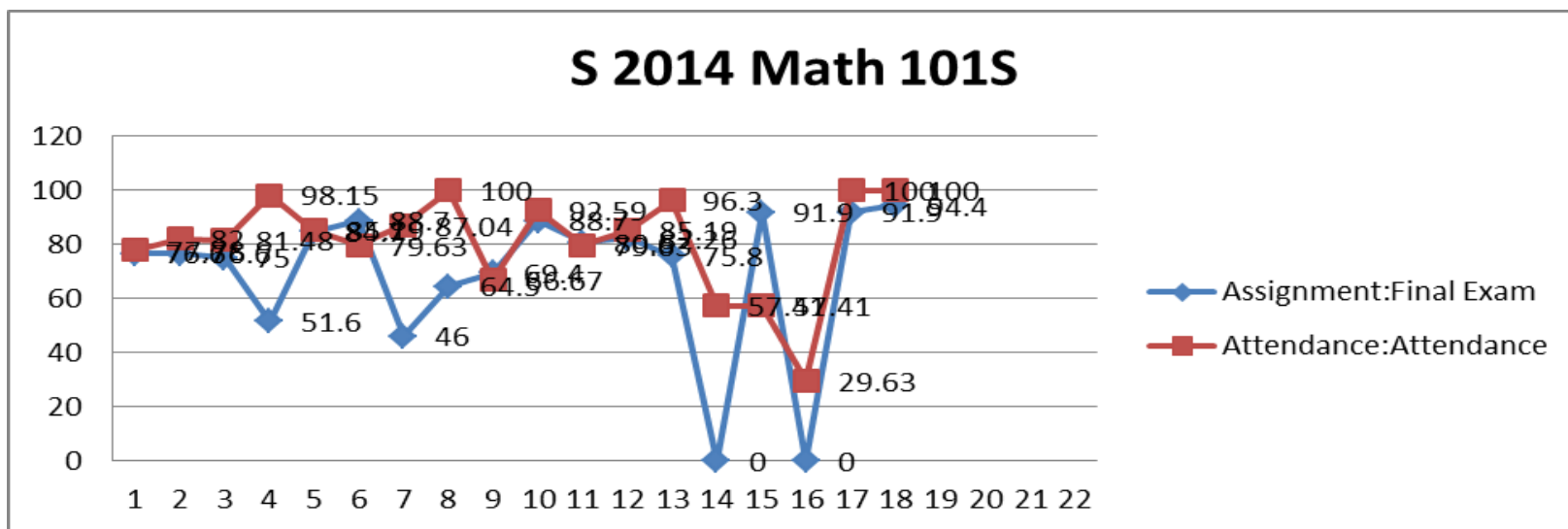
An analysis of the mathematics specialist’s Spring 2014 Math 101S class (which is being used as a representative sample of the total Math 101S population) shows the various areas that students excel in along with where they need more support. Students excelled in Chapter 9 and had difficulties with Chapter 15. Chapter 9 covered real numbers and algebraic expressions while Chapter 15 covered solving systems of equations by graphing, substitution, and elimination methods.

The distribution of Final exam scores is shown below.



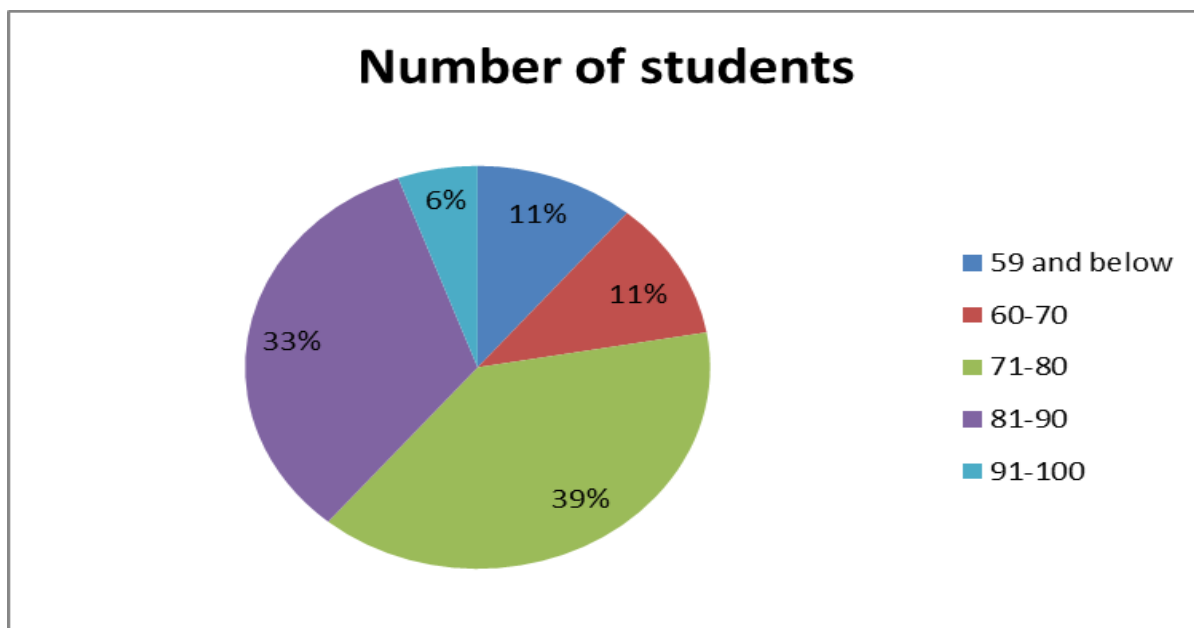
The scores cluster nicely above the 70's with a few outliers in the 40's and 50's. Two students did not take the exam is indicated by the dots on 0.

Final exam distributions are shown below in relation to attendance rates.



Attendance was strongly correlated with performance on the Final exam. Students with high attendance averages, tended to have higher scores on their Final exams. Interesting, and different from Math 100, hours in the study plan, did not seem to have much of an effect of students’ overall course averages for Math 101S students. This can likely be attributed to the fact that students got so much extra help and practice during lab, that it made the study plan seem like overkill.

The benefits of having a lab however are best illustrated below.

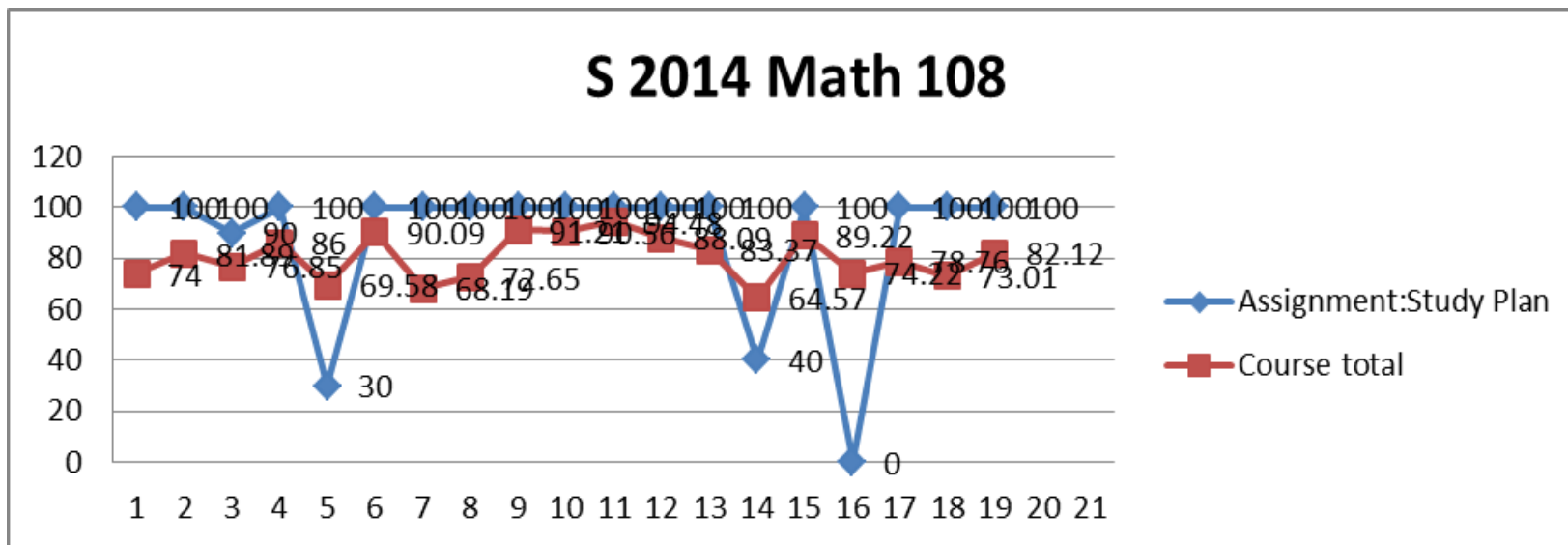


The above graph shows the breakdown of overall course averages of students in Math 101S. 78% of students scored above 70% in the course.

### ***Math 108***

An analysis of the mathematics specialist’s Spring 2014 Math 108 class (which is being used as a representative sample of the total Math 108 population) shows the various areas that students excel in along with where they need more support. Students excelled in Chapters 8 and 11 and had difficulties with Chapters 2-3. Chapters 8 and 11 covered unit conversions and financial mathematics while Chapters 2-3 covered sets and logic.

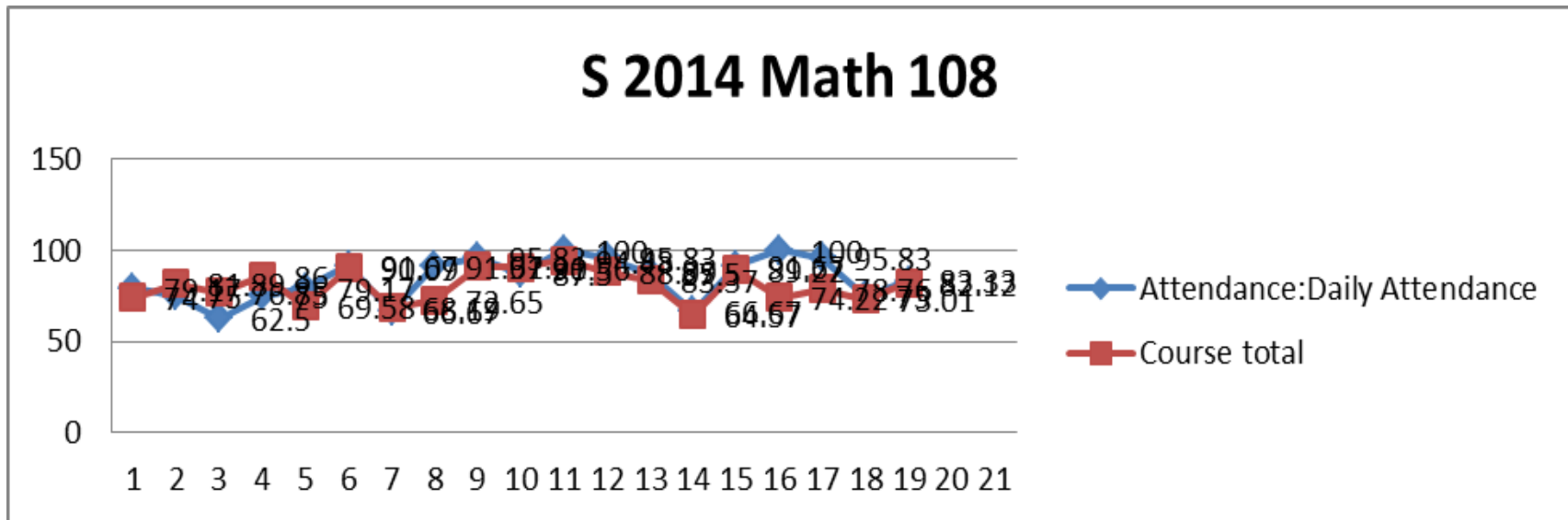
One of the striking findings is shown below.



There is a very strong correlation between hours that students put into the study plan in MML and high course overages. Of the students who did well in the course, most got quite a bit of practice in the study plan. What is clear that students with low course averages had very low study plan averages. The correlation is slightly stronger here, than for Math 100.

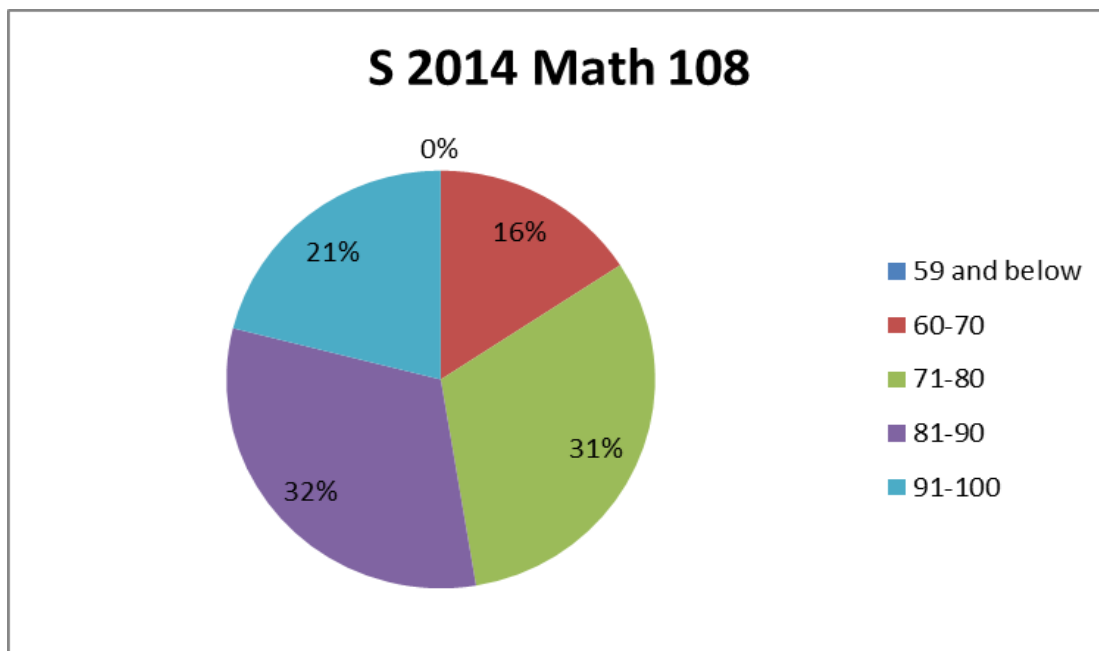
Another interesting finding is shown below.





There is an extremely strong correlation between attendance rates and students’ overall course averages. This supports the research that students who attend class, will do better than those who do not.

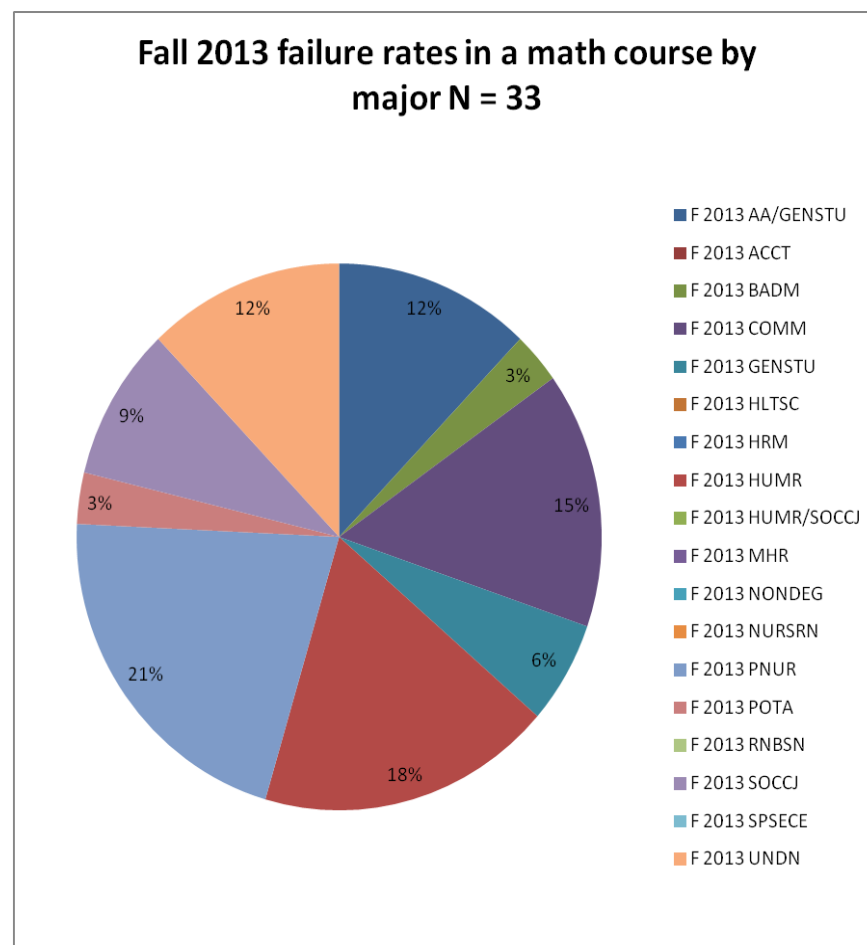
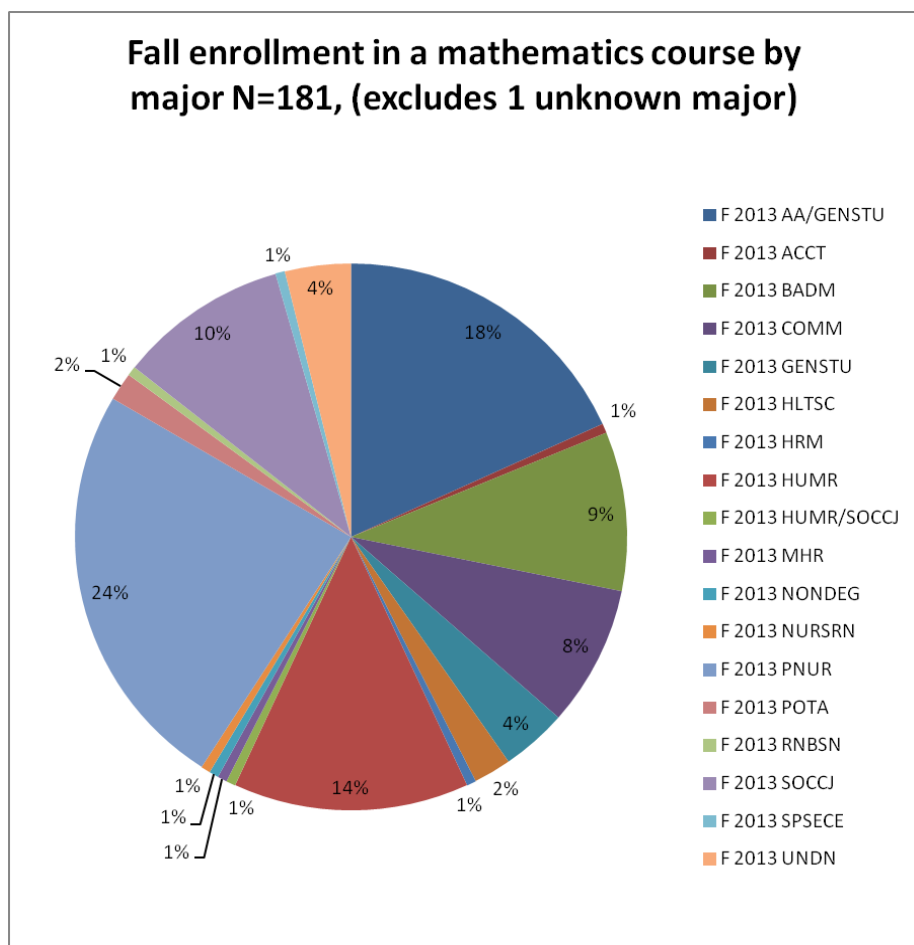
Overall course averages are shown below.



84% of students passed the course with a score above 70%. This suggests that the course is easier for students to handle than it is for them to handle the pre-foundational courses. This makes sense due to the limited coverage of fraction operations, equation solving and graphing in the Math 108 course, topics which are more heavily covered in 100-101S.

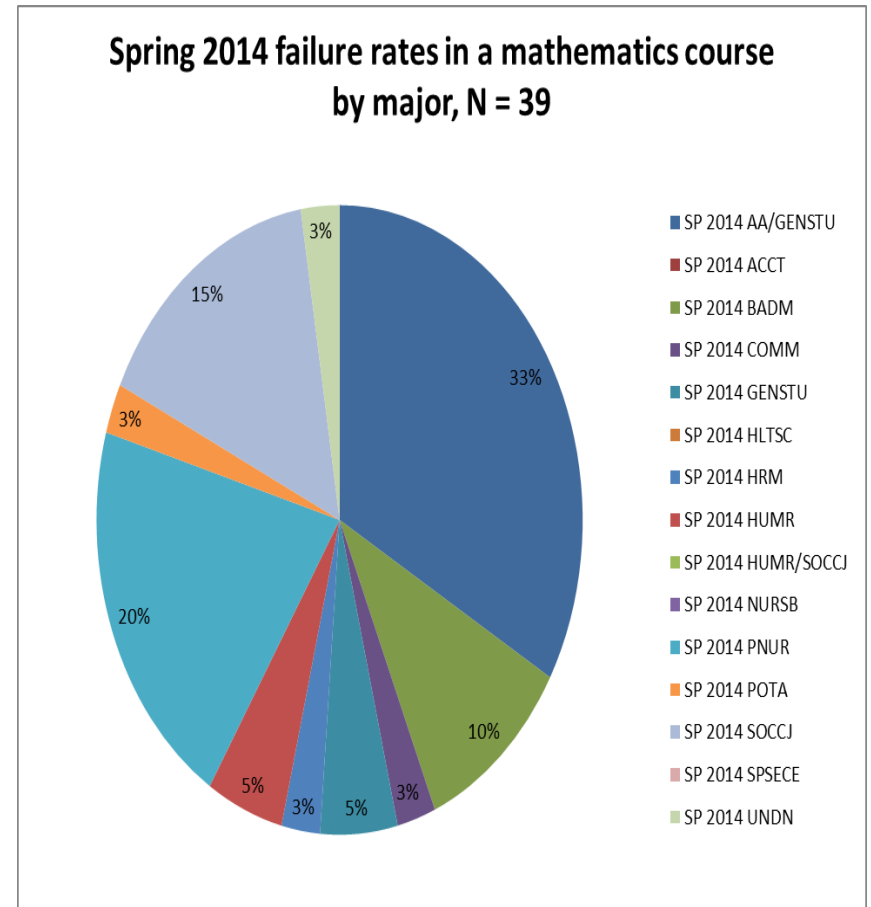
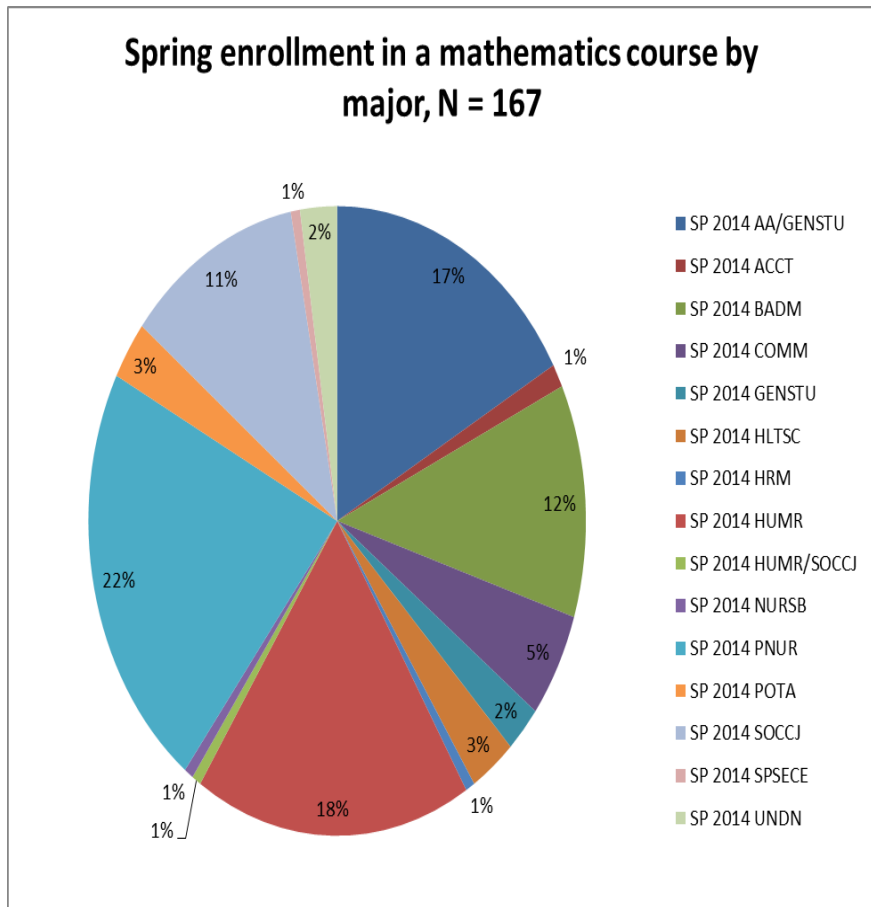
### Mathematical trends amongst various majors

The next two figures represents all students taking a mathematics course, broken down by major during Fall 2013.



The largest portions of students registered were students on Main campus majoring in PNUR, followed by general studies at THEARC, and main campus students majoring in HUMR. The graphs reveal that although undecided majors only made up 4% of math enrollment during Fall 2013, they made up a disproportionately higher 12% of failure rates. Similarly, COMM majors only made up 8% of math enrollment, yet made up a disproportionately higher 15% of failure rates. HUMR majors made up 14% of math enrollment yet failure was at 18%. Most all other majors failed at rates that were proportional to enrollment.

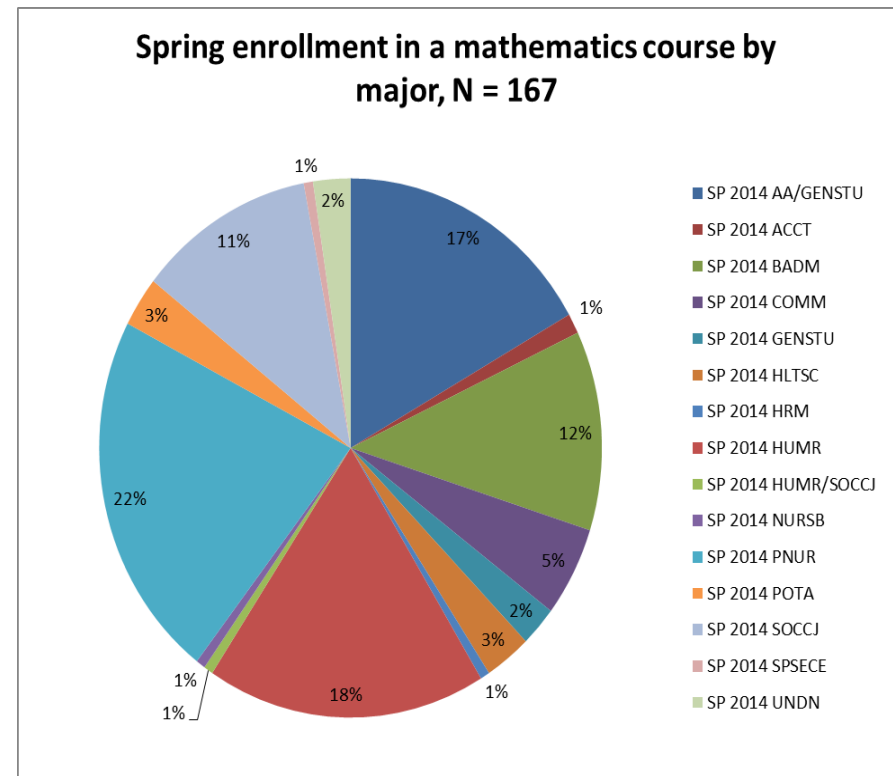
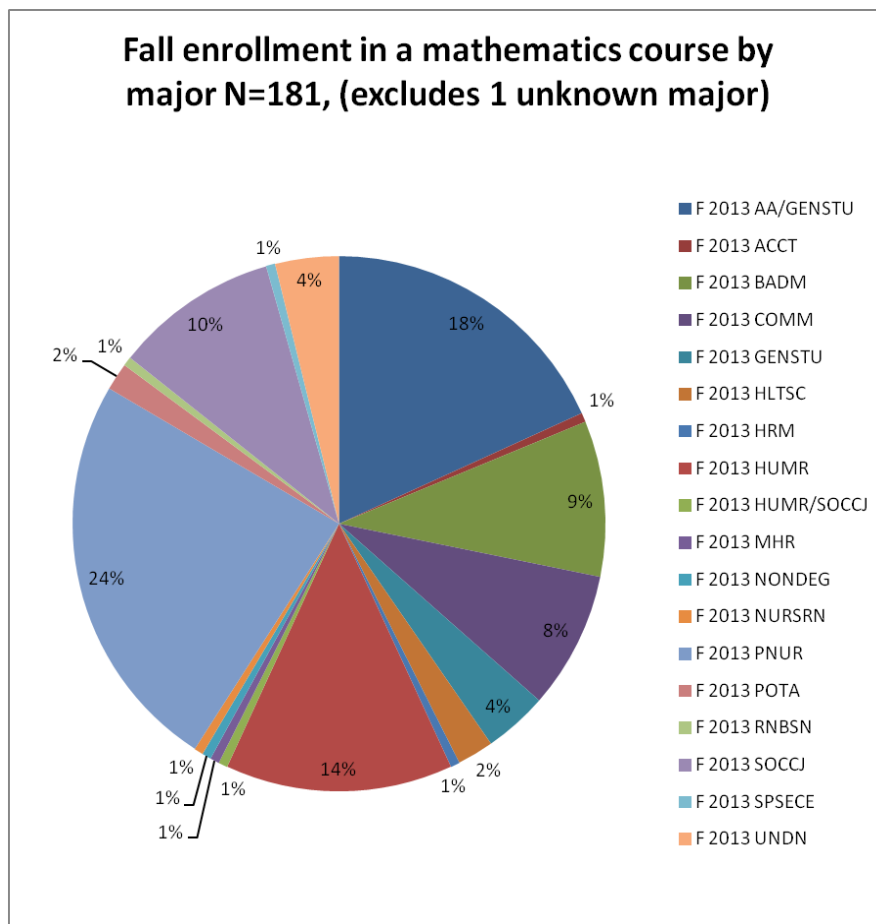
The next two figures represent all students taking a mathematics course, broken down by major during Spring 2014.



The largest portions of students enrolled in a mathematics course are PNUR students followed by HUMR majors, BADM majors, and students majoring in general studies at the THEARC. These graphs reveal that although students majoring in general studies at THEARC made up only 17% of math enrollment, their failure rate was a disproportionately higher 33%, almost double. GENSTU

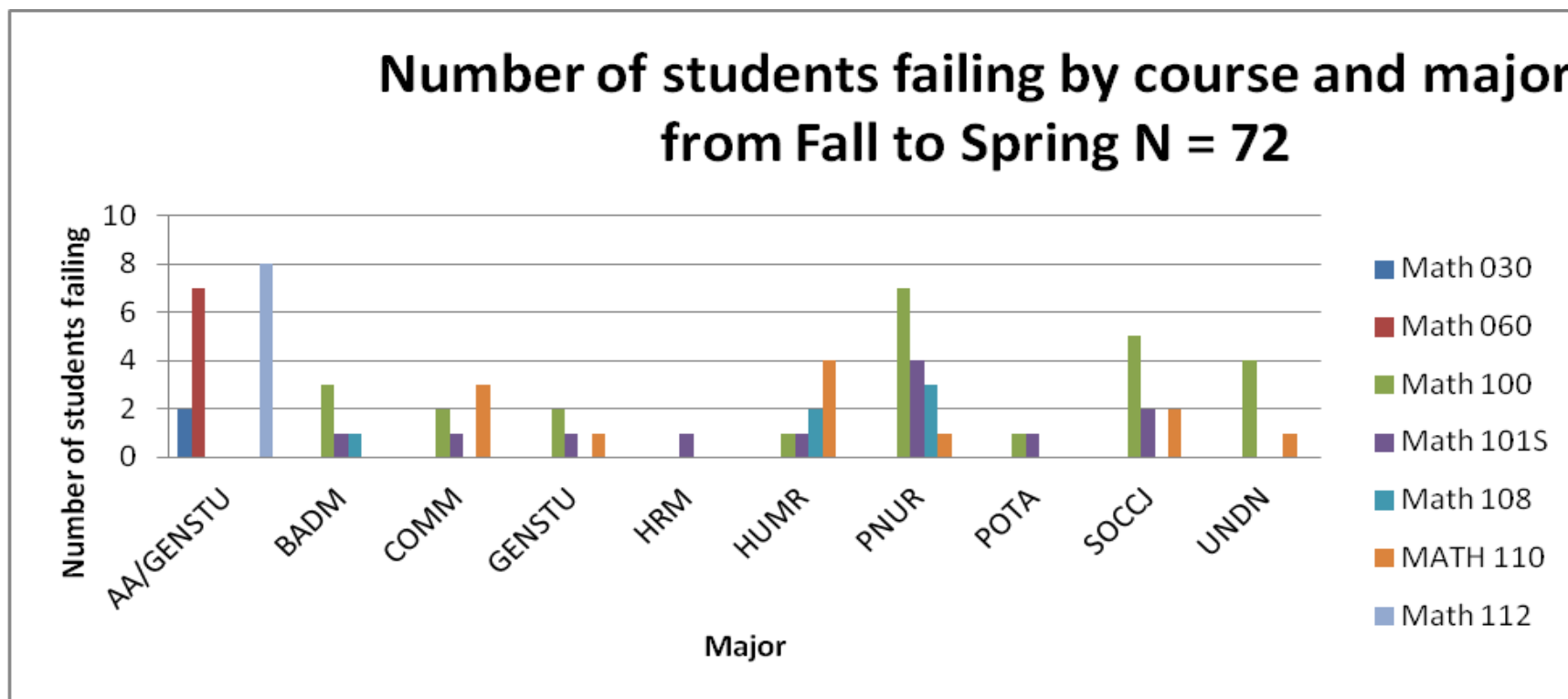
majors students made up 2%, yet failure rates were a disproportionately higher 5%. SOCCJ majors made up 11% of math enrollment, yet made up 15% of failure rates. Most all other majors failed at rates that were proportional to enrollment.

Below are side by side comparisons of Fall 2013 and Spring 2014 mathematics course enrollment.



The first thing to note is that there were no NURSB majors enrolled in a math course during the Fall 2013, and no MHR, NONDEG, NURSRN, RNBSN majors enrolled in a mathematics course during the Spring 2014, thus colors in the graphs may not be a direct match. These graphs reveal the there is a decline in math enrollment for COMM majors from 8% to 5% and a decline for UNDN majors from 4% to 2%.

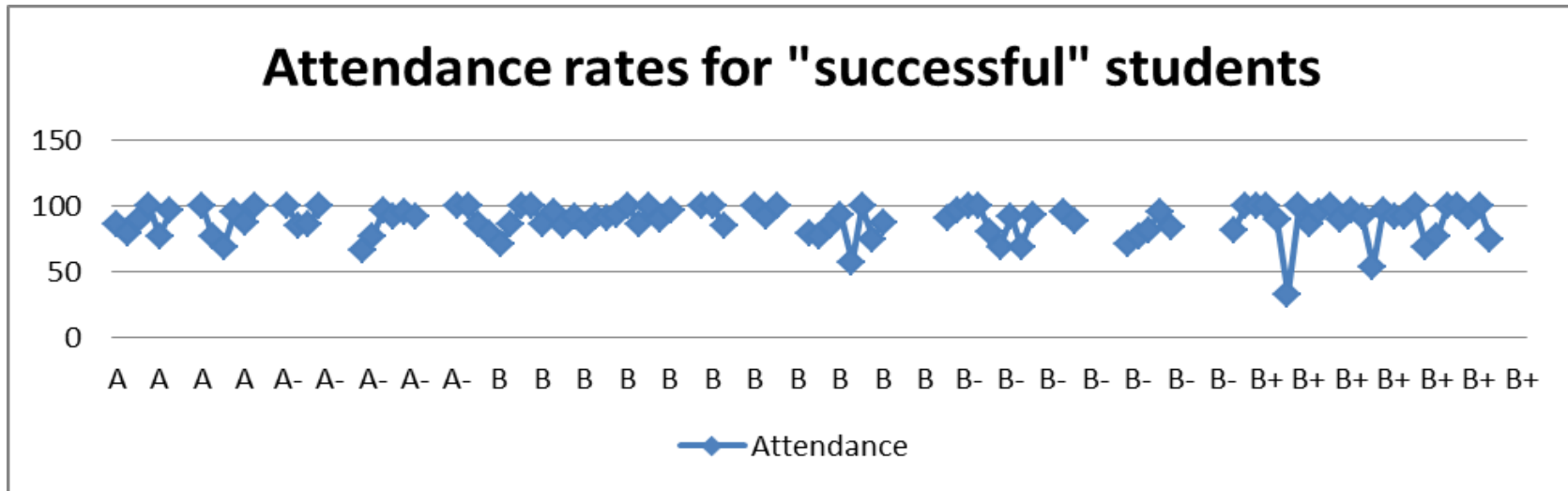
Below is a graph illustrating numbers of students failing, broken down by course and major across both Fall and Spring semesters.

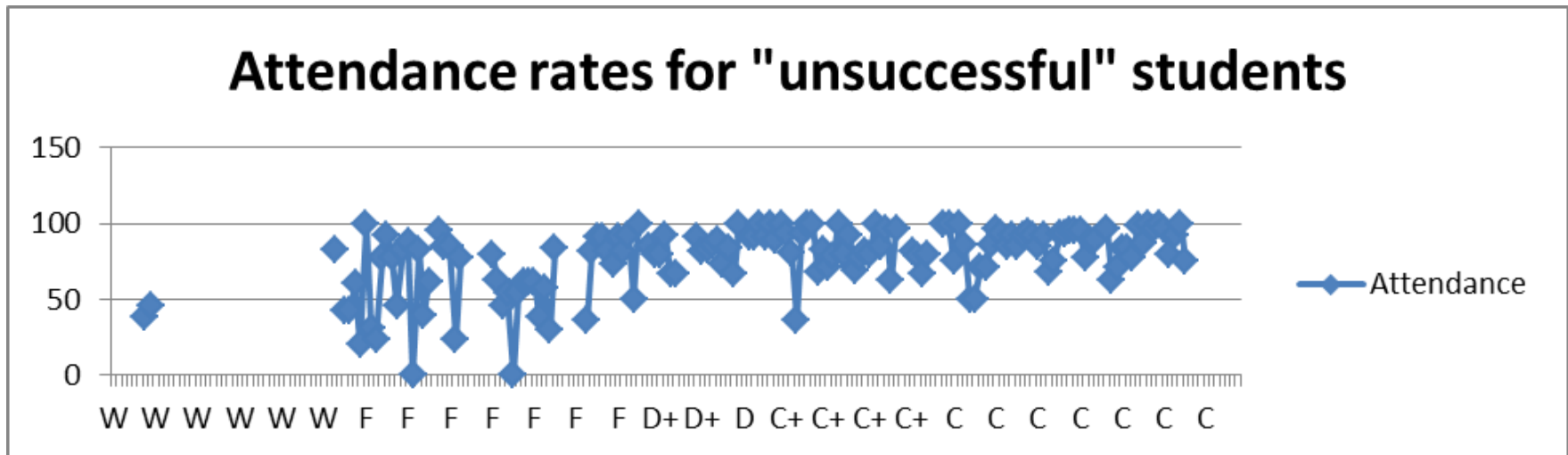


From this graph it becomes clear that AA/GENSTU majors struggle the most with Math 060 and Math 112, followed by PNUR majors who struggle the most with Math 100, and SOCCJ struggling the most with Math 100 in relation to the other courses.

### Successful Students

Below I compare attendance rates for students who earned A's or B's during either semester with students who earned lower than a B-





There is a stark contrast between these two graphs. Successful students had consistently high attendance rates while unsuccessful students had clusters of students with rates below 50. Students that get A's and B's are students that go to class.



The table below shows the non-repeating students that earned A’s during either Fall or Spring semesters by status and major.

Count of Final Grade				Final Grade
College Attend Status	Curriculum	Course ID	Repeated	A
FTS	PNUR	MATH 101S	N	1
		MATH 108	N	2
	<b>PNUR Total</b>			3
<b>FTS Total</b>				3
FYTR	HLTSC	MATH 110	N	1
	<b>HLTSC Total</b>			1
<b>FYTR Total</b>				1
TRAN	COMM	MATH 100	N	1
		MATH 110	N	2
	<b>COMM Total</b>			3
	GENSTU	MATH 060	N	1
	<b>GENSTU Total</b>			1
	HLTSC	MATH 100	N	1
	<b>HLTSC Total</b>			1
	HUMR	MATH 110	N	1
	<b>HUMR Total</b>			1
	PNUR	MATH 100	N	1
		MATH 108	N	3
	<b>PNUR Total</b>			4
<b>TRAN Total</b>				10
<b>Grand Total</b>				14

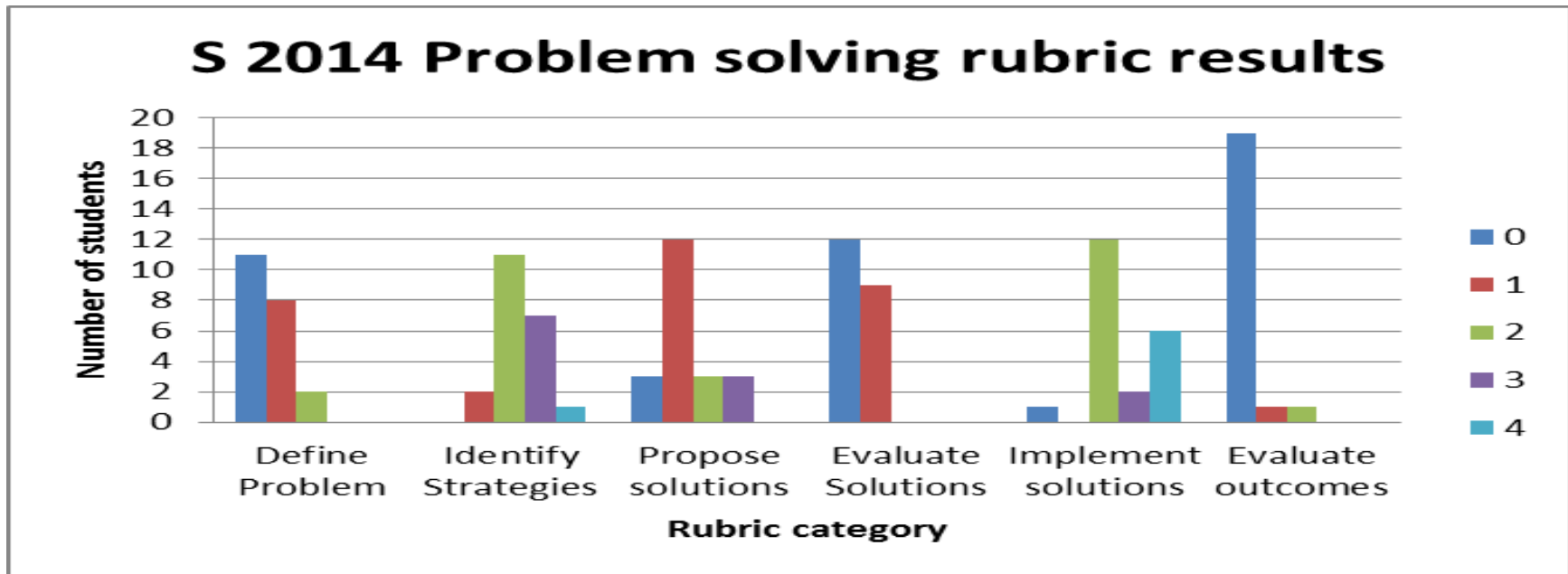
The data shows several things. First, transfer students are twice as likely as first time students to get A’s in their mathematics course. Second, when looking at transfer students, PNUR majors have the highest numbers of A’s. One could say that this is because PNUR majors make up one of the largest populations of SPS. However, there are potentially other factors at play here. One, PNUR must do well in mathematics to pass the nursing test (TEAS) and get into the nursing program. This means there is a motivational aspect at work here that is not present or necessary for other majors. Also, these PNUR majors who get A’s are getting them, not so much in the

pre-foundational classes, but in Math 108 and Math 110 (for COMM as well). It is quite possible that a significant number of PNUR majors have transferred in the equivalent of Math 100 and Math 101S, the two mathematics courses that present challenges for many Trinity students. Third, the data reveals that certain majors are not even represented i.e. those students did not earn A's and may or may not have been repeating the course. Specifically, BADM and SOCCJ majors are not represented.

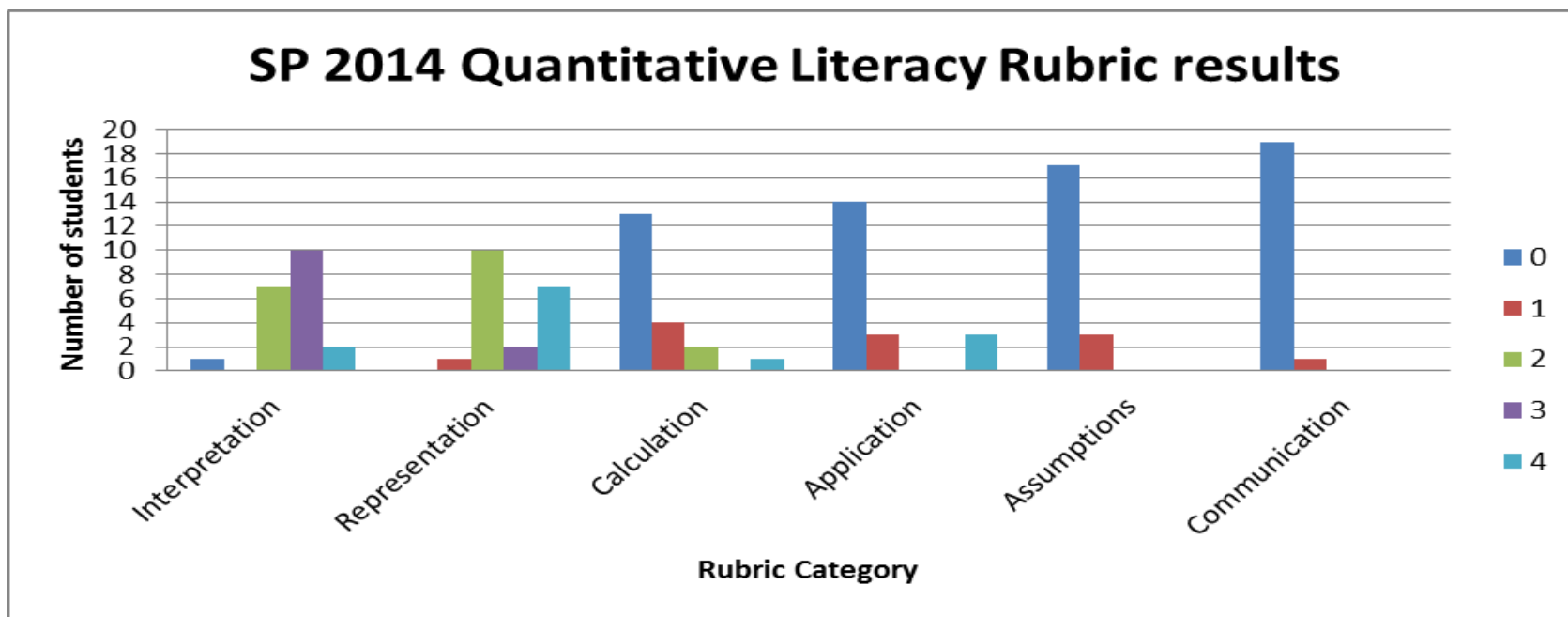
This data raises several questions? One is there something in the preparation of transfer students that is fundamentally different from the preparation of students who do not transfer, and if so, is it something that SPS needs to adopt? Second, is there something in the preparation of PNUR majors that is fundamentally different from the preparation of other majors, if so, what is it, and is missing from the preparation of non PNUR majors? Are PNUR just more mathematically inclined and if so, how do we get other majors to become more inclined? Further exploration is needed.

## **Rubrics Project Findings**

Below are findings from the specialist's Math 108 course in the Spring 2014 in which assignments were graded using a problem solving rubric and a quantitative literacy rubric. The results are displayed below.



The graph shows that students’ strengths lie in implementing solutions i.e. showing how a problem is solved and getting the answer, and in identifying strategies for solving. Students’ display great weakness however with evaluating their outcomes (final answers), evaluating their proposed solutions, and defining a problem statement.



The graph shows that students’ strengths lie in interpretation and representation i.e. explaining information presented and converting mathematical information into tables, diagrams etc. Students’ display great weakness however with communication, assumptions, application, and calculation. These categories seek for students to be able to perform accurate calculations, draw appropriate conclusions based on analysis, make important assumptions in data analysis, and express quantitative evidence in support of an argument.

### Recommendations

Similarly to Math 101S, the pre-foundational course Math 100 would be better supported with a complementary supplemental lab. As of Fall 2014, all Math 100 courses are scheduled to run with the lab class. This will allow students to receive reinforcement of concepts, ask more questions, and work on homework. Labs should ideally focus on strengthening fraction and integer operations skills. Incorporation of a lab might lead to a decrease in the numbers of students who have to repeat this course.

Students who have to repeat a mathematics course need more supports for their second attempt to prevent there having to be a third (particularly for Math 100). These students would benefit from specialized support groups that meet weekly or bi-weekly and focus on cultivating good study habits and class habits and provide tutoring for these students.

Program chairs/advisors for GENSTU, SOCCJ, HUMR, COMM, and undecided majors need to identify strong students that can serve as mentors for less successful students. These mentors can meet up on a weekly basis with students to provide mathematical support. A group can be established, for example, something like “Coffee and Conversation” or “HUMR math club.” In essence, some kind of group or “guided study session” would benefit students with these majors in particular. Students with these majors are especially vulnerable because although the majors don’t require much mathematics in practice (which may be a part of why the student selected the major), the mathematics is still required for graduation. Additionally, the importance of good attendance must be stressed for students. The data supports the research that successful students are those who study and go to class.

Students at THEARC were failing at rates that were disproportionate to their enrollment size. Unlike Main campus students, these students do have supplemental labs that accompany their pre-foundational courses, but are the population that need it the most. Math 030 and Math 060 need to become Math 030S and Math 060S in order to assist this population in becoming more successful.

As educators, there is much that we learn from researching the ways that transfer students are being prepared mathematically. Transfer students are typically more successful, and we need to understand why and how we can take their preparation and apply it to the School of Professional Studies. Similarly, PNUR majors seem to be more prepared and more successful in their foundational mathematical courses than other students. Understanding more about their mathematical history and preparation, allows programs to adapt and apply their methods.

Expressing ideas in writing is a major weakness for students. This might explain student challenges with projects in Math 110. In one problem solving activity in particular, it was surprising in terms of the number of students that could not define a problem statement. Students don’t seem to have had enough exposure to expressing ideas in mathematical contexts. Students need lots of examples of how to do this along with practice doing it themselves. Supplemental lab is one venue for this type of exposure. Another would be activities embedded within the classroom. Alternatively, weekend workshops run by adjuncts might be another venue.