



Calculus I Use of Student Support Programs for Mathematics

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Figure 1. Math Learning Center



Figure 2. Typical SI Session

BACKGROUND

The use and study of peer to peer (P2P) learning has exploded in recent years. In this study, we focus on two P2P services: Supplemental Instruction (SI) and the Math Learning Center (MLC). We want to first explore the effectiveness of the services, the overlap between them, and the degree to which each service is used by various different populations.

Unique qualities of peer leadership services:

- Fayowski and MacMillan (2008) found that providing peer tutoring early in the college career can result in significant improvement regardless of prior academic performance.
- It is not just the *time spent* studying, but specifically the *interpersonal connections* that students construct when working with peers instead of professors (Laskey, & Hetzel, 2011).
- Tutees appreciate listening to peers who communicate at their level (Santee, 2006)
- Tutoring can be particularly influential for
 - minorities (Barlow & Villarejo, 2004)
 - Commuters (Hoffman, Richmond, Morrow, & Salomone, 2002)
 - Transfer students (Grillo & Leist, 2013)

RESEARCH QUESTIONS

We explored the following questions as they relate to students in Math 150 (Calc I) between 20174-20184.

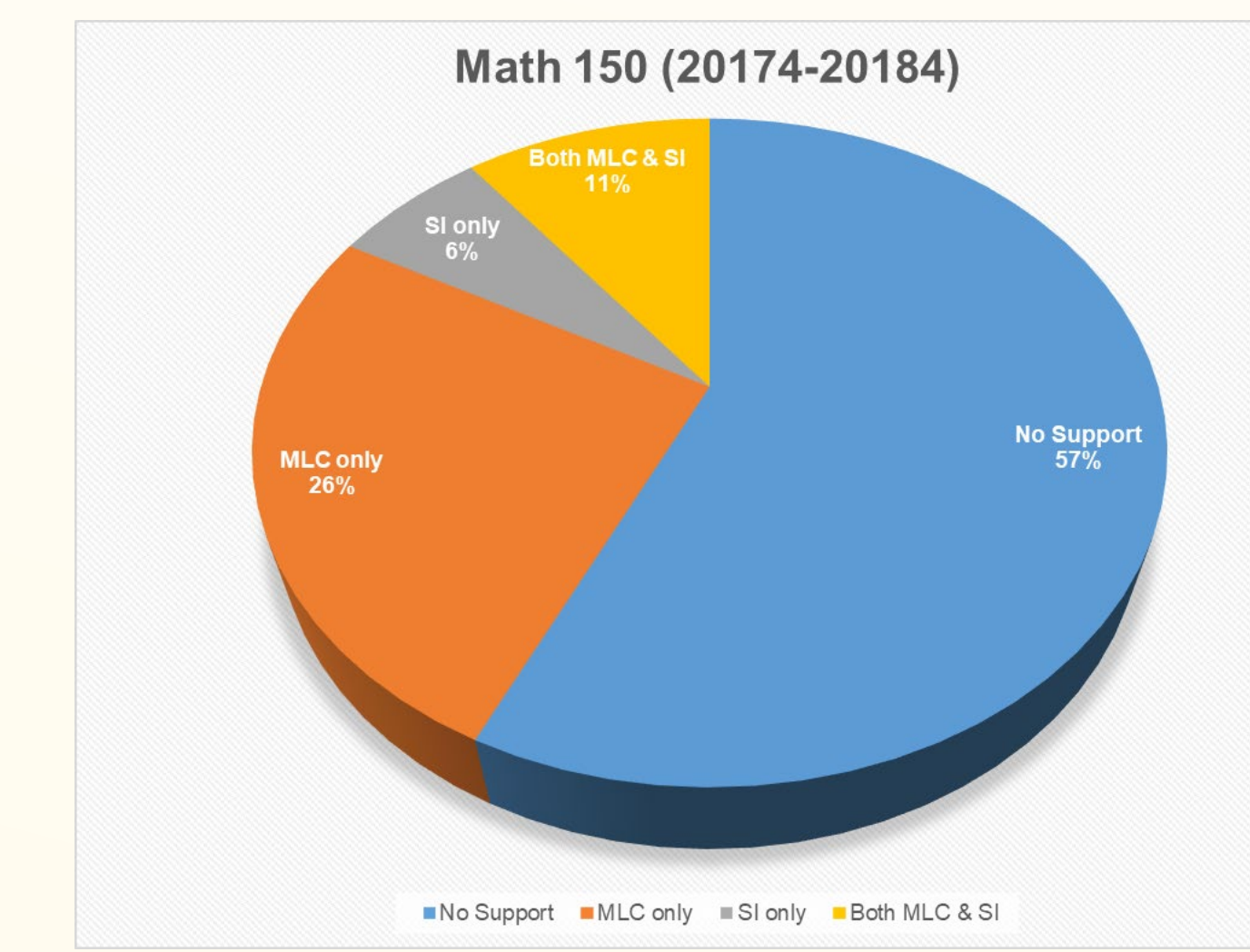
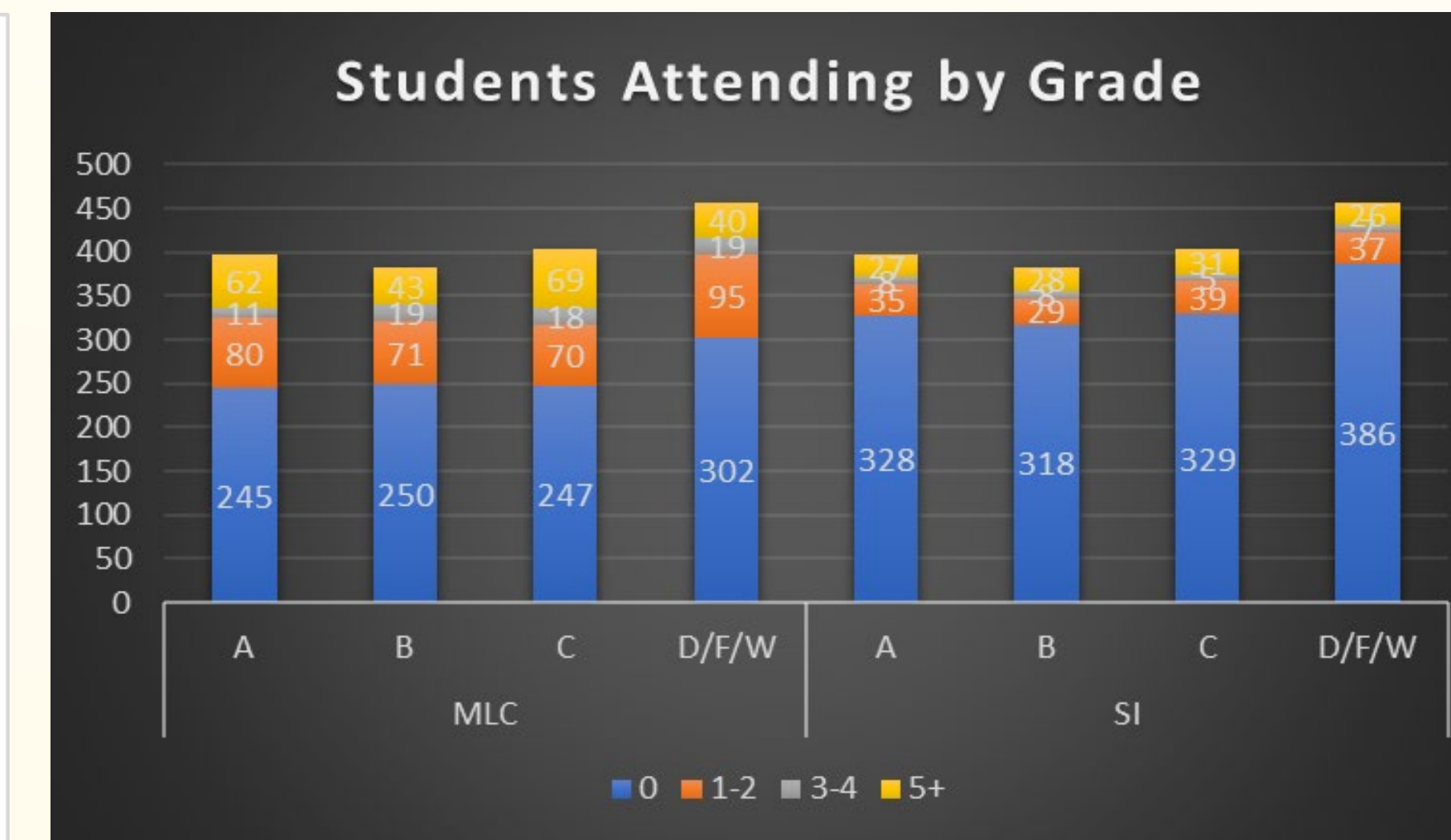
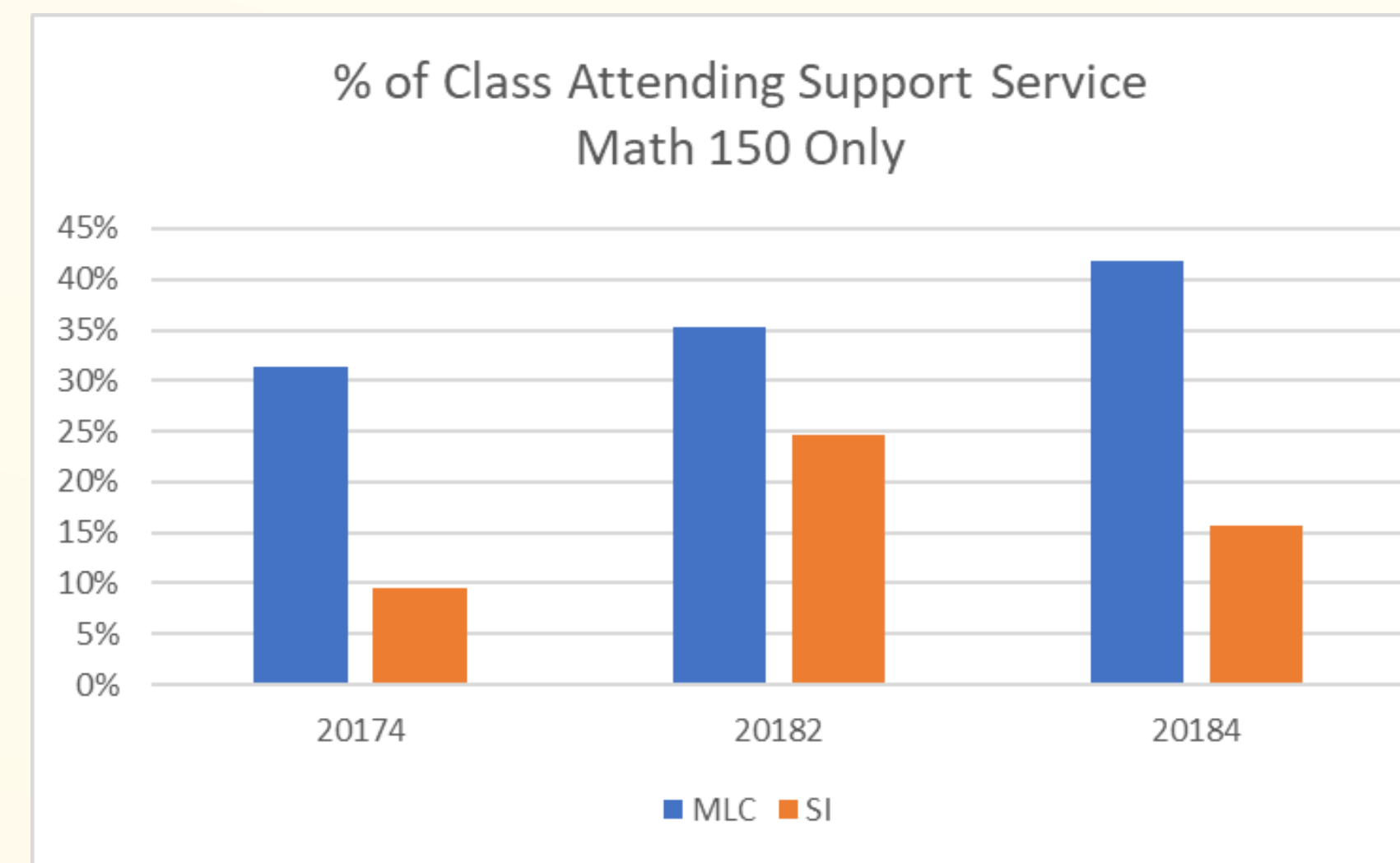
- What are attendance trends for MLC and SI? How much overlap is there between the MLC and SI programs?
- What are some demographic characteristics of each set of users?
- Removing selection bias, what is the probability of increasing one's grade if a student attends one or more of the services?
- What are the outcomes for visitors versus non-visitors?
 - Do more visits ensure better outcomes? What is the grade distribution for users of each service?
 - Did either service have a disproportionately positive effect on students of color?

METHODS: PSM

- Creating a logistic regression model to assign weights to each of the co-variables in our model. $P(\text{attend MLC}) = B_0 + B_1x_1 + b_2x_2 + \dots$
- Use the weights to compute a propensity score for each student. This score represents the probability that a student will pass a class given the student's particular values.
- Develop a "caliper" tolerance. Match a treatment (visitor) with a control (non-visitor) based on being within caliper distance of the PSM score.
- Check the balance between each confounding variable in the control and treatment groups. Strong confounders should be eliminated, or choose a better matching method.
- Create a model that compares MLC (or SI) vs. non as the x and Grade (0-4) as response. Run the model to find the p-value to determine if the treatment (SI or MLC) was a significant predictor of higher outcome.
 - (MLC/SI/both)

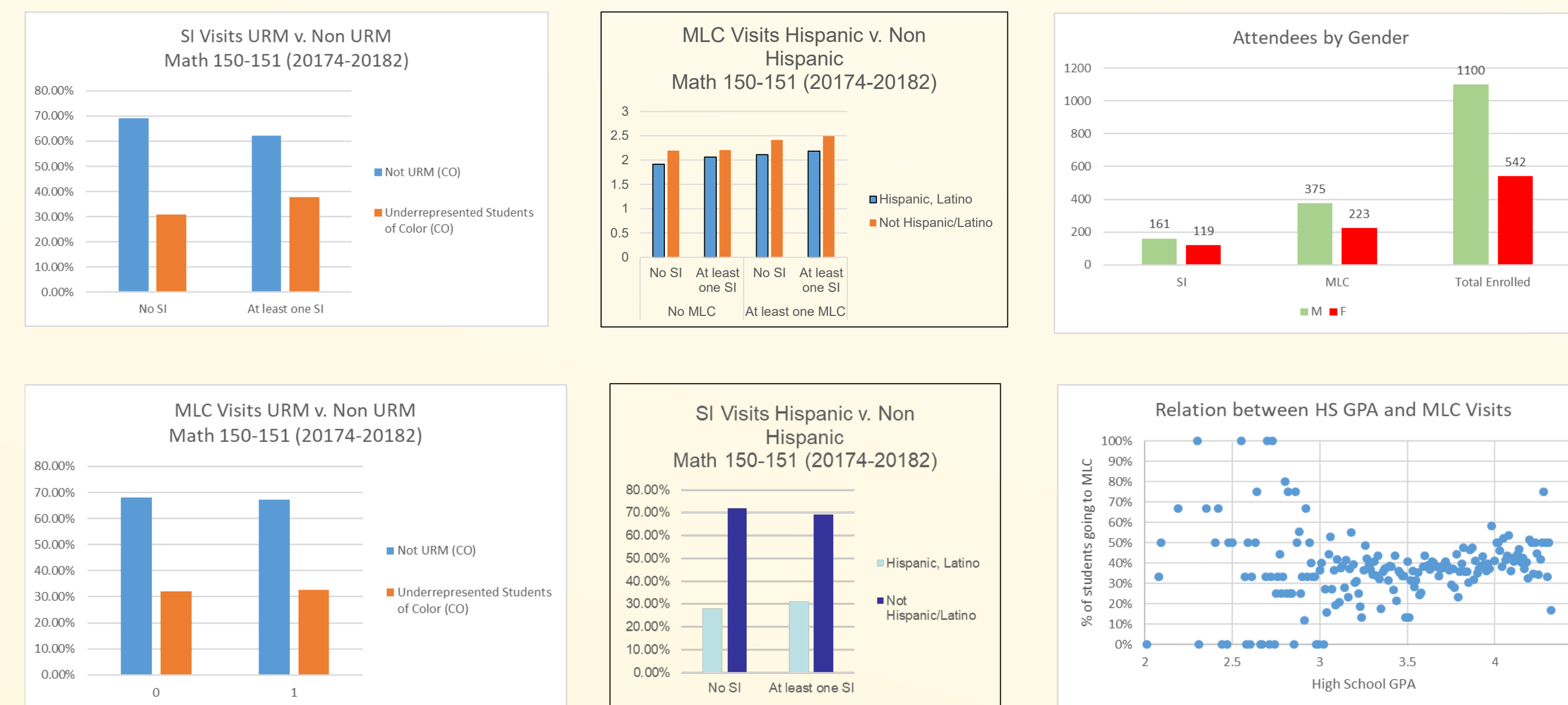
FINDINGS

Q1: Attendance Patterns for MLC and SI

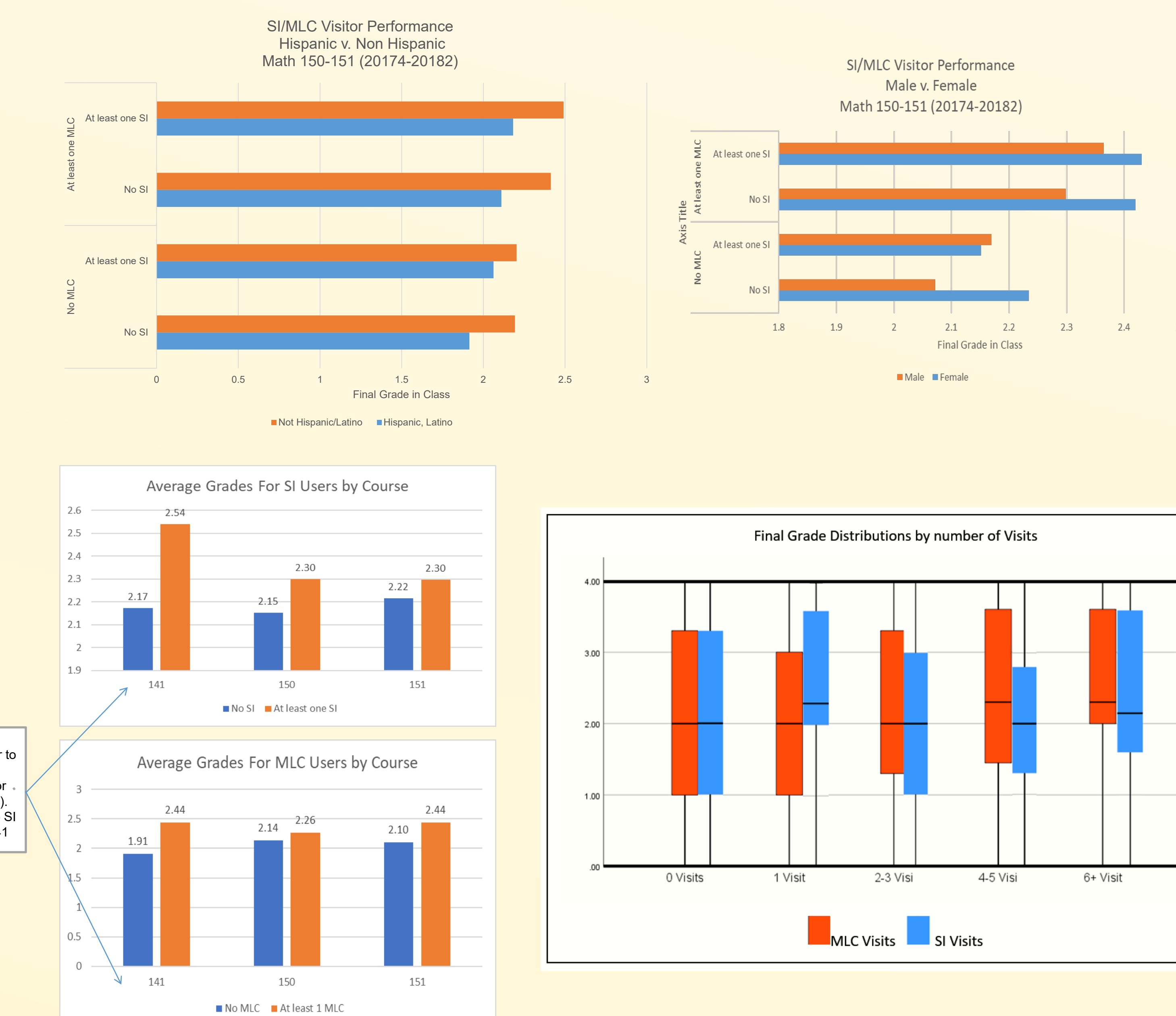


	MLC	SI
Females	34.00%	45.00%
Hispanic	30.00%	36.00%
URM	38%	45%
Military	2%	2%
Incoming GPA	3.68	3.73
Avg SAT	1149	1146
Avg ACT	25	24.5

Q2: Attendance by Ethnicity and Gender, HS Grades, GPA



Q4: Achievement for Visitors and Non-Visitors



NOTE: These refer to SCI 296 (required for commuters). There is no SI for Math 141

Q3: Results of Propensity Score Matching

First analysis, the students were matched based on a treatment of if they had gone to the MSLC for Math 150.

- All 572 students that were 'treated' were matched with students who were not 'treated', for a total of 1144 students. After accounting for other academic and demographic variables the regression showed that **students that attended the MSLC for Math 150 earned a course grade, on a 4.0 scale, on average 0.18 higher than students that did not attend the MSLC for Math 150** ($p = 0.0003$).
- Also, for each additional visit up to 11 visits to the MSLC a students course grade increased by 0.026 on average ($p < 0.0001$).

Second analysis, the students were matched based on a treatment of if they had gone to the MSLC or attended a SI session for Math 150.

- All 644 students that were 'treated' were matched with students who were not 'treated', for a total of 1288 student. After accounting for other academic and demographic variables the regression showed that **students that attended the MSLC or SI for Math 150 earned a course grade, on a 4.0 scale, on average 0.13 higher than students that did not attend the MSLC or SI for Math 150** ($p = 0.025$).

CONCLUSIONS & FUTURE DIRECTIONS

- Both SI and MLC have visit rates for Hispanics and URM that are proportional to the population
- Hispanics perform slightly lower than non-Hispanics but their performance is enhanced by both services.
- There is very little overlap (11-12%) between MLC and SI. Students interviewed stated that the two services are very different, and both are useful.
- There appears a slight jump in grades for those who attend only 1 SI; both services show slight uptick for increased numbers of visits.
- SI offers a friendly atmosphere where peers help each other on problems that the leaders create; MLC is more individually-based.

FUTURE DIRECTIONS:

- Hire more tutors and SI leaders of color to recruit more diverse students to provide role models to encourage all student to seek support services
- Offer workshops for students seeking "review" or extra help in the MLC
- Continue the 1-1 tutoring program and encourage its use

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