

SUPPLEMENTAL INSTRUCTION EFFECTIVENESS REPORT
Winter 2016

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PROGRAM OVERVIEW

The Race to STEM program aims to achieve six program objectives including:

- **Objective 2:** Increase the percentage of STEM Academy students and college-wide STEM students who successfully transition from Bridge-to-STEM to STEM by successfully completing both college-level Math and enrollment in at least one core science course.
- **Objective 3:** Increase the percentage of students, especially Hispanics, who complete the Citrus STEM Academy Program as measured by completion of at least one transfer-level Math course, at least one transferable core science course, and completion of a STEM Academy approved project.

One of the primary strategies in achieving these objectives is through Supplemental Instruction. Supplemental Instruction targets traditionally difficult academic courses and provides regularly scheduled, informal out-of-class review sessions led by the Supplemental Instruction Leader, a student who has successfully taken the course. Supplemental Instruction Leaders will plan and conduct study sessions two times a week, directly before or after the class.

To assess the efficacy of Supplemental Instruction on student outcomes, the following three research questions should be investigated:

- Question #1: Does participation in Supplemental Instruction increase the likelihood of success in basic skills and college level math courses?
- Question #2: Is there a difference on final course grades between Supplemental Instruction participants and non-participants for basic skills and college level math courses?
- Question #3: Does the frequency of attending Supplemental Instruction lead to the achievement of higher final course grades for basic skills and college level math courses?

EXECUTIVE SUMMARY

Supplemental Instruction (SI) was offered for four courses in math to a total of 296 students. Descriptive and inferential statistics were utilized to investigate the effects of SI on final course grade. SI participants were designated as having attended one or more sessions during the winter term; final grade was measured on the following continuous scale: A = 4, B = 3, C = 2, D = 1, F/FW/W = 0. For all courses mean final course grade was greater for participants than for non-participants (see figure 2 on page 7).

A One-Way Analysis of Covariance revealed that mean final course grade is not significantly different between SI participants and non-participants in any course.

Table 1
Executive Summary

| Research Question | Statistical Technique | Result |
|---|-----------------------|------------------------|
| Q.1: <i>Is there a difference on final course grades between Supplemental Instruction participants and non-participants for basic skills and college level math courses?</i> | One-Way ANCOVA | No significant results |

METHODS

The current analysis evaluates Supplemental Instruction in relation to meeting STEM program objectives. The purpose of this investigation is to examine the underlying hypothesis that Supplemental Instruction (SI) positively affects student outcomes by addressing one primary research question (stated above). SI was offered for four courses in math, across nine sections to a total of 296 students.

Table 2
Winter 2015 enrollment and sections supported

| Course | <i>n</i> | SI Supported Sections |
|---------|----------|-----------------------|
| MATH029 | 74 | 3 |
| MATH030 | 70 | 2 |
| MATH032 | 39 | 1 |
| MATH150 | 113 | 3 |
| Total | 296 | 9 |

Analytic Strategy

Descriptive statistics were used to depict SI participation across relevant demographic characteristics such as gender and ethnicity; course comparisons were also assessed. Inferential tests were evaluated at 0.05 α level. Additionally, final grade was operationalized as a continuous variable and comparisons were made for each course between participants and non-participants.

Inferential Statistics: Addressing Q.2

A One-way Analysis of Covariance (ANCOVA) was performed to determine if there is a statistically significant difference in mean final course grade between SI participants and non-participants while controlling for preexisting GPA. Final grade was measured on the following continuous scale: A = 4, B = 3, C = 2, D = 1, F/FW/W = 0. SI participants were designated as students whom attended one or more sessions of SI. To reiterate, the variables in this study include:

Dependent Variable: Final Course Grade (continuous)

Independent Variable: SI Participation (Participant/Non-Participant)

Covariate: Preexisting GPA (prior to Winter 2016).

RESULTS

Descriptives

Ethnicity breakdown by course is shown below. Hispanic students ($n = 202$) made up the highest percentage of students in all courses.

Table 3.1
Ethnicity breakdown by course

| | Hispanic | | White | | Asian | | Other | | Total | |
|---------|----------|-----|-------|-----|-------|-----|-------|----|-------|------|
| | # | % | # | % | # | % | # | % | # | % |
| MATH029 | 55 | 74% | 10 | 14% | 3 | 4% | 6 | 8% | 74 | 100% |
| MATH030 | 49 | 70% | 10 | 14% | 5 | 7% | 6 | 9% | 70 | 100% |
| MATH032 | 26 | 67% | 9 | 23% | 2 | 5% | 2 | 5% | 39 | 100% |
| MATH150 | 72 | 64% | 18 | 16% | 13 | 12% | 10 | 9% | 113 | 100% |
| Total | 202 | 68% | 47 | 16% | 23 | 8% | 24 | 8% | 296 | 100% |

In MATH032, male the proportion of male participants was marginally greater (18% to 16%) for males than females. For all other courses, a greater percentage of females attended SI than did males.

Table 3.2
SI participation by course and gender

| | Male | | | | Female | | | | Total | | | |
|---------|------|-----|----|-----|--------|-----|----|-----|-------|-----|-----|-----|
| | P | | NP | | P | | NP | | P | | NP | |
| | # | % | # | % | # | % | # | % | # | % | # | % |
| MATH029 | 9 | 13% | 27 | 38% | 10 | 14% | 26 | 36% | 19 | 26% | 53 | 74% |
| MATH030 | 14 | 22% | 18 | 28% | 15 | 23% | 18 | 28% | 29 | 45% | 36 | 55% |
| MATH032 | 7 | 18% | 12 | 32% | 6 | 16% | 13 | 34% | 13 | 34% | 25 | 66% |
| MATH150 | 22 | 20% | 28 | 25% | 28 | 25% | 34 | 30% | 50 | 45% | 62 | 55% |
| Total | 52 | 18% | 85 | 30% | 59 | 21% | 91 | 32% | 111 | 39% | 176 | 61% |

*9 students did not disclose gender, 4 participants and 5 non-participants

**P= SI participant/NP= Non-Participant; participants defined as having attended ≥ 1 SI session

***Percentaged across by total number in course

Figure 1 provides a descriptive comparison of the covariate in this study: preexisting GPA. In MATH029, the students are nearly equal in academic ability. In MATH030 and MATH150, participants have greater preexisting GPA's while in MATH032 non-participants exhibit greater preexisting GPA's.

Figure 1: Mean Preexisting GPA by Participation and Course

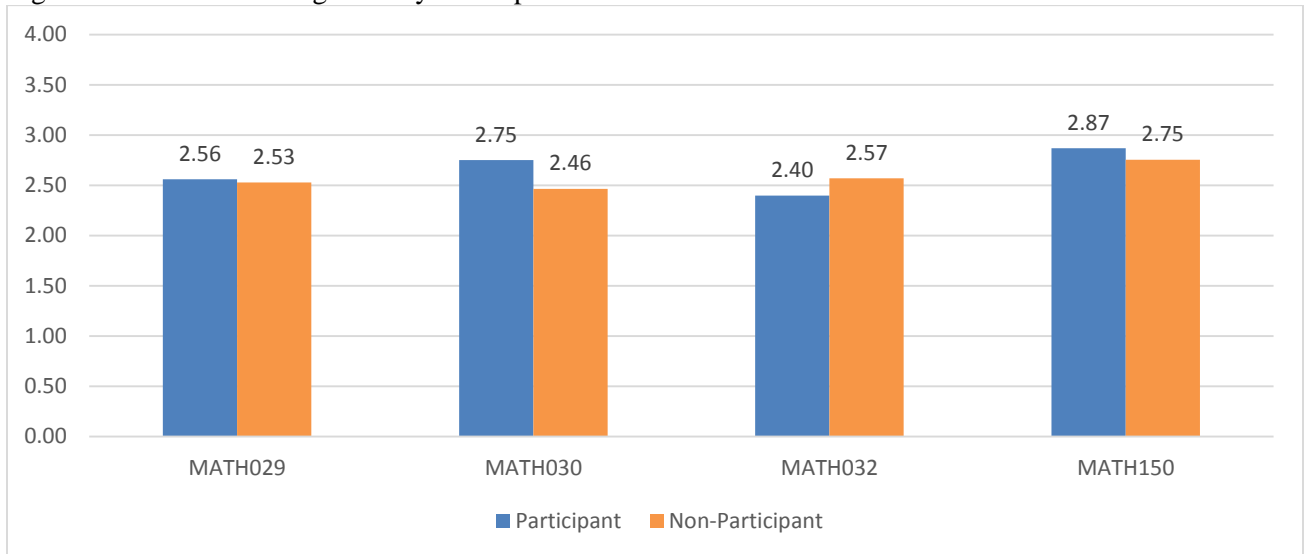
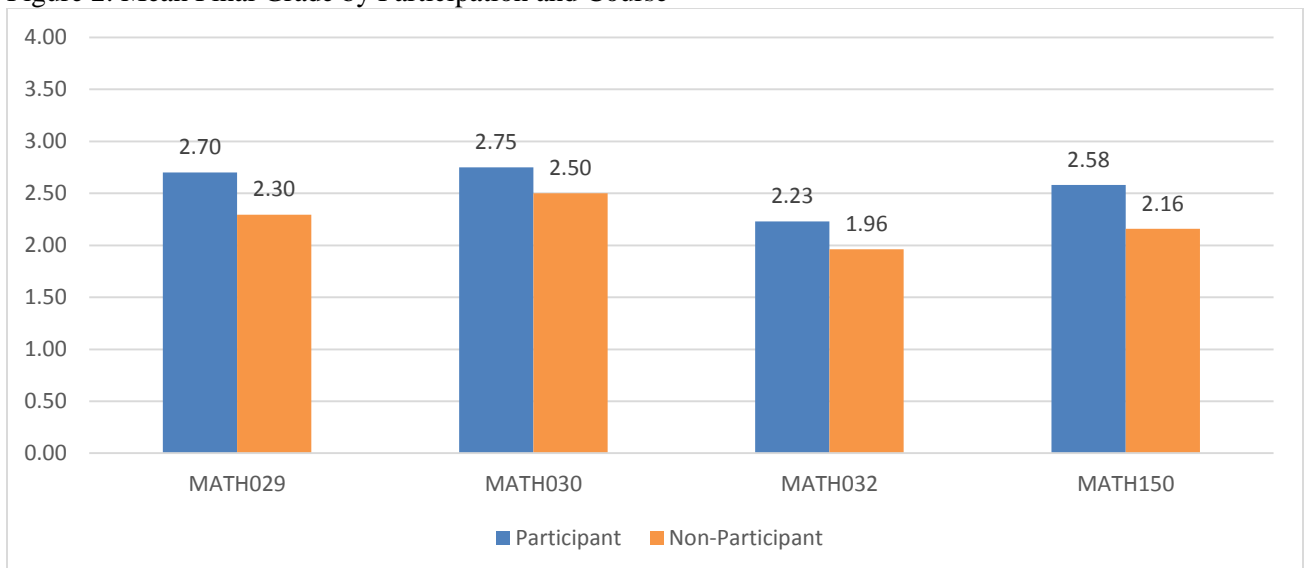


Figure 2 provides a descriptive comparison of the outcome in this study: course final grade. Participants showed greater mean final course grade than non-participants, however this mean is unadjusted for preexisting GPA.

Figure 2: Mean Final Grade by Participation and Course



Pre-Analysis

Data was examined for outliers prior to running the main analysis. For all courses, each assumption was tested to determine if the data was suitable for ANCOVA. The assumption of independence was met as SI participants and non-participants did not significantly differ on the covariate, preexisting GPA. All between group variances fell within the 10:1 ratio; ensuring the homogeneity of variance assumption for participation group was met. As an additional assumption unique to ANCOVA models, the assumption of homogeneous regression slopes was tested by examining the interaction between GPA and participation groups: there was no significant interaction between GPA and participation groups for any course. Since the data for each course met all assumptions associated with ANCOVA, the researcher continued onward to the primary analysis.

Inferential Test

MATH029

A One-way ANCOVA was conducted to determine a statistically significant difference between SI participants and non-participants on final grade controlling for preexisting GPA. The covariate, GPA, was significantly related to final grade, $F(1, 65) = 67.10, p < .001$, partial $\eta^2 = .51$. There is no significant effect of SI participation on the course final grade after controlling for preexisting GPA, $F(1, 65) = 1.24, p = .27$, partial $\eta^2 = .019$.

MATH030

A One-way ANCOVA was conducted to determine a statistically significant difference between SI participants and non-participants on final grade controlling for preexisting GPA. The covariate, GPA, was significantly related to final grade, $F(1, 63) = 58.83, p < .001$, partial $\eta^2 = .48$. There is no significant effect of SI participation on the course final grade after controlling for preexisting GPA, $F(1, 63) = 0.33, p = .57$, partial $\eta^2 = .005$.

MATH032

A One-way ANCOVA was conducted to determine a statistically significant difference between SI participants and non-participants on final grade controlling for preexisting GPA. The covariate, GPA, was significantly related to final grade, $F(1, 30) = 21.07, p < .001$, partial $\eta^2 = .41$. There is no significant effect of SI participation on the course final grade after controlling for preexisting GPA, $F(1, 30) = 1.81, p = .18$, partial $\eta^2 = .06$.

MATH150

A One-way ANCOVA was conducted to determine a statistically significant difference between SI participants and non-participants on final grade controlling for preexisting GPA. The covariate, GPA, was significantly related to final grade, $F(1, 96) = 74.33, p < .001$, partial $\eta^2 = .43$. There is no significant effect of SI participation on the course final grade after controlling for preexisting GPA, $F(1, 96) = 0.311, p = .58$, partial $\eta^2 = .003$.

Table 3.3
Adjusted and Unadjusted Mean Final Course Grade for SI Participation

| | SI | Adjusted Mean | Unadjusted Mean |
|----------------|-----------------|----------------------|------------------------|
| MATH029 | Non-Participant | 2.54 | 2.30 |
| | Participant | 2.82 | 2.70 |
| MATH030 | Non-Participant | 2.83 | 2.50 |
| | Participant | 2.71 | 2.75 |
| MATH032 | Non-Participant | 2.26 | 1.96 |
| | Participant | 2.74 | 2.23 |
| MATH150 | Non-Participant | 2.73 | 2.16 |
| | Participant | 2.62 | 2.58 |

CONCLUSION

For the winter 2016 term, participants had greater mean final course grades than non-participants for all of the courses which offered SI support. However, final course grade does not significantly differ between participants and non-participants while controlling for a key academic aptitude variable, preexisting GPA. According to this analysis, SI has no effect on mean final course grade.