Successful Engagement: Active Learning in Mathematics

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Abstract/Introduction

Mathematics serves as the gateway to a variety of STEM fields, but students struggle in mathematics courses during the first two years of college. Faculty are challenged in constructing entry level mathematics courses that engage all learners since students enter the classroom with different educational goals, backgrounds, preparation levels, expectations, and needs and practices successful at one institution may not be easily replicable in a different environment (Conference Board of the Mathematical Sciences, 2016). Additionally, while online courses have increased in prevalence in the last decade, they have been shown to have lower levels of student engagement (Burch, Heller, Burch, & Heller, 2016). However, classes employing active learning techniques have higher success rates than traditional lecture classes (Freeman et al., 2014) and may profoundly affect performance of marginalized students (Theobald et al., 2020). Successful Engagement: Active Learning in Mathematics (SEAL-M) has designed a series of professional development opportunities for mathematics instructors to construct and adopt inclusive active learning lessons and engage in a mentorship program to help transform mathematics instruction at Valencia College, a two-year HSI. Participants in the project report increased classroom engagement and connection, increased familiarity with active learning techniques, decreased comfort in implementing equity-minded classroom practices, and increased awareness of barriers to active learning. Preliminary classroom data, although not statistically significant, suggests a trend towards closing achievement gaps in the classrooms of participating instructors.

Research Questions

- To what extent does a mathematics faculty development program, consisting of a Summer Institute, Mentor Training, and a Mentorship Program, influence growth mindset belief and mitigate perceived barriers to AL implementation at a large, two-year Hispanic Serving Institution?
- Is there a correlational relationship between faculty knowledge and attitude towards equity mindedness and AL implementation in a mathematics setting?

Method

- **Mentor training**
  - Spring, asynchronous with one Zoom meeting
  - 2 PD hours
- **Destination**
  - College-sponsored 5-week PD
  - Mentors & Mentees
  - Active learning & inclusive teaching practices
- **Summer Institute**
  - Mentors
  - Course redesign & guest speaker
  - Active learning & inclusive teaching practices
- **Fall Mentorship Program**
  - Mentors & Mentees implement AL lessons
  - Mentors & Mentees observe one another and have regular meetings
- **Data Collection**
  - COPUS coding of mentees classes in Spring and Fall
  - Pre- and Post-surveys
  - Weekly mentee surveys
  - Focus Groups
  - Student outcomes

Details of the Summer Institute Curriculum, Mentorship Program, and Faculty Redesign can be found by scanning the QR code:

Preliminary Results

Year 1 Student Outcome Data:

Avg GPA by Seal-M Status and Non-White Status (Onsite Only)

Seal-M Status	Non-White Status	
	White	Non-White
Non-Seal-M	2.236	2.047
	1127	3830
Seal-M	2.33	2.335
	197	782

Figure 1 – Average Course GPA Collegewide

Avg GPA by Course, Seal-M Status, and Non-White Status (Onsite Courses Only)

Course	Non-Seal-M		Seal-M	
	White	Non-White	White	Non-White
MAC1105	2.354	2.247	2.333	2.393
	254	748	33	112
MAC1114	2.743	2.257	0	2.688
	74	210	1	16
MAC1140	2.348	2.066	2.8	2.826
	69	198	10	23
MAC2233	2.529	3.4	2.667	2.556
	17	40	3	9
MAC2313	1.8	1.875	1.462	2.423
	10	24	13	26
MAT0022C	2.096	1.942	2.56	1.683
	73	377	25	63
MAT1033C	2.009	1.841	2.31	2.214
	344	1329	58	379
MGF1106	2.259	2.103	2.632	2.717
	197	638	19	53
MGF1107	1.8	2.235	3.333	2.941
	15	51	3	17
STA2023	2.432	2.135	2.156	2.679
	74	215	32	84

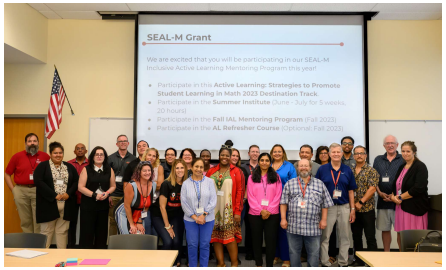
Figure 2 – Average Course GPA Collegewide by Subject

Limitations

Apparent impact of SEAL-M training may be due to the self-selection effects of the best teachers wanting to undertake the training first.

Qualitative Data

- Mentees reported discussing active learning with colleagues and feeling supported by mentors
- Mentors reported experiencing a mutual learning mentoring relationship
- Mentors and mentees reported seeing increased student engagement
- Mentors and mentees continued to see student preparation as a barrier to active learning as well as insufficient time to prepare and implement lessons
- Mentees report difficulty implementing active learning in an online environment
- Mentors report decreased comfort implementing equity-minded classroom practices
- About one fourth of the Year 2 mentees reported using student feedback to improve active learning lessons



Discussion

Presented data is preliminary and student outcome data is complicated by low sample sizes and the omission of mixed mode and online courses. However, the preliminary data suggests the intervention is effective at increasing student outcomes for nonwhite students.

Faculty, particularly at two-year colleges with heavier teaching loads, often lack adequate preparation time which impedes implementing inclusive active learning in the classroom. The designed intervention provides mentors with an opportunity to focus on redesign of one course and allows mentees the opportunity to introduce inclusive active learning in a supportive environment. Both mentors and mentees benefit from peer feedback regarding lesson design and implementation.

Both mentors and mentees report benefits from the program and would recommend the program to other instructors. Both mentors and mentees report increased student engagement and feel more knowledgeable about inclusive active learning techniques. All developed lessons are available in the SEAL-M repository at the QR code:

References

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