

WIP: Status of Mathematics, Engineering, Science Achievement (MESA) Engineering Program at SJSU

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Abstract— This innovative practice WIP paper describes the results for Engineering and Computer Science Students who participated in the Math Engineering, Science Achievement (MESA) Engineering Program (MEP) at San Jose State University. Students who participated in MESA/MEP have greater retention and graduation rates than students who did not participate in MEP. While the percentage of Hispanic students participating MEP has remained high at 45%, there has been no growth in Hispanic student participation. The percentage of Pell Grant Eligible students participating MEP has grown from 32% to 50%. This work describes the MEP program at SJSU and the focus groups used to evaluate the program.

Keywords—*HSI, Pell Grant, MESA, MEP, DEI, Equity*

I. INTRODUCTION

In this work, intended to be a Work in Progress Paper in the Research-to-Practice Category, preliminary results from an expansion of the Math Engineering, Science Achievement (MESA) Engineering Program (MEP) supported by a U.S. Department of Education Hispanic Serving Institution are presented, along with a description of the MESA program.

Mathematics, Engineering, Science Achievement (MESA) was founded in 1970 and is administered by the University of California. Through MESA College Prep, MESA Community College, and MESA University, found at institutions throughout the state of California, MESA provides motivation and support to thousands of pre-college, community college, and university students in science, engineering, computer science, and other math-based fields.

The advantages of mentoring for Hispanic undergraduate students are well-established in the literature [1-5]. The constructivist educational theory supports the effectiveness of peer mentors in the MESA program [6-8].

Intended outcomes: The intended outcome is to increase graduation rates of Hispanic and Low-income students in engineering or computer science majors at a Hispanic-serving institution.

II. MEP PROGRAM AT SJSU

The MEP program at SJSU is managed by a full-time director and full-time coordinator. In addition, there are two peer mentor coordinators, one student engagement advisor, and 10 peer mentors. (The university funds the director position and one-half of the coordinator position. The grant funds the rest of the staff.) The MEP program has two corporate sponsors, Lockheed Martin, and VMware. In addition, the MEP program has an Industrial Advisory Board.

The program works closely with four on-campus affinity groups: Black Alliance of Scientists and Engineers (BASE), Society of Asian Scientists and Engineers (SASE), Society of Latino Engineers and Scientists (SOLES), and Society of Women Engineers (SWE).

Students apply to the MEP program each year, and the director ensures that the students meet the eligibility requirements of being regularly matriculated students enrolled in engineering (including technology) or computer science programs. Students must also have a proven economic or educational disadvantage.

Each semester begins with a kick-off event where the students are reminded about the requirements of the program and what the events of the semester will be. Typical events include professional development events such as resume workshops, mock interviews, and company information sessions, and social events such as taco night, or bowling. The professional events prepare the students for a career and the social events encourage networking with their peers. There are also weekly study sessions often staffed with industry volunteer tutors who provide assistance with a variety of subjects including Math, Physics, and other Engineering courses. The year ends with a MESA awards banquet.

The College of Engineering has provided a dedicated study space with a table for small group work, computers, and lockers. In addition to the open study, there is a quiet study space. There is also room for peer mentors to meet with students semi-privately.

The MEP program has two kinds of mentors: Peer mentors who are currently MEP students, who help newly admitted students acclimate to the university in a big brother/big sister

fashion and industrial mentors who help students connect to industry professionals.

The MEP program provides advising to all first, second-year undergraduate students as well as transfer students. The new students are assigned a MEP Peer Advisor (MPA) with whom they must meet on a monthly basis. MPAs become a “go-to” person for students needing support or guidance on navigating the college system, major requirements, on-campus resources, student life and involvement.

There are approximately 90 student visits to the MEP office each week for activities such as drop-in advising, scheduled advising, general questions, affinity group storage (BASE, SASE, SOLES, and SWE), study room access, snacks, pick up graduation gifts pick up goodie bags. There are approximately 300 student visits to the MEP study center each week.

III. METHODOLOGY

The cohort size and retention/graduation data of the students of the College of Engineering and the department of Computer Science was taken from the University Dashboard which can be found here: <https://xxx.edu/irsa/>. The data was subdivided into ethnicity and Pell Grant status for first time admits (freshman) and first-time transfers. The data is collected from the dashboard once a year after the fall census date. Retention in this work is defined as a student who is taking courses at SJSU or graduates with a degree from SJSU. This work looks at fall 2021-2023, which are the first three years of the department of education grant. Students can be in both the Hispanic group and the Pell Grant group.

The Ethnicity Pell Grant status of each MEP student was collected by the SJSU Institutional Research and Strategic Analytics group. Students are tagged in the advising software package when they join MEP, and the director cleans up the membership list once a year.

To evaluate student perceptions of the MEP program two focus groups were held, one in the spring of 2022 and one in the spring of 2023. There were 18 and 17 students who participated in the focus groups respectively. Each year two separate focus groups were held. The first year’s focus groups were done via zoom and the second year’s focus groups were conducted face to face. The focus groups were run by the grant evaluator, WestEd.

The focus group questions and student consent form were all approved by SJSU’s Institutional Research Board. Consent was obtained via Docusign during the recruitment phase during the first semester of each AY. Students were not rewarded for participating in the focus group. The SJSU IRB Protocol Tracking Number: 21263

The questions asked during each focus group were as follows:

A. Student Participation in the MESA program

- Did any one of you participate in the program in the last academic year?
- What guided your decision to participate in the MESA program in this academic year?
- The offer of stipends for summer internships working on research projects led by SJSU Engineering faculty?
- Idea of camaraderie with other engineering students?
- Meet people?
- Were you recruited to join MESA?
- Did you attend MESA events to help you decide whether to join?
- Did you receive or see MESA promotional material? Was it helpful in your decision to join?
- What convinced you to apply?

B. Application process.

- Did you meet with a MESA (or MEP) advisor?
- Was this helpful? Please describe and give an example.

C. Effectiveness of MESA Peer Mentor

- How often have you met with your MESA Peer Mentor since the semester began?
- Have these meetings with your MESA Peer Mentor been useful? In what way?
- What instructions/guidance did you receive from your MESA Peer Mentor?
- What have you discussed with your MESA Peer Mentor? Prompts include:
 - Campus resources
 - Academic support
 - Prepare for major advising
 - Student involvement
 - Policies and procedures
 - Financial aid basics
 - Guided major and internship research
 - Resume and interview preparation

D. Thoughts about the MESA Program

- In what types of activities have you participated through MESA? Prompts include:
 - Study sessions
 - Academic workshops
 - Academic advising
 - Professional development
 - resume blast
 - mock interviews
 - industry mixer
 - Community development
 - study room access
 - social events such as field day, ice cream social, etc.
- Have these events been helpful to you? Please describe.

- Have you encountered any problems participating in the MESA program?
- Do you feel supported by your MESA peer mentor?
- Has the MESA program helped you attain an internship in your field?
- Do you think that you have performed better in your academic program in ways that you could attribute to having participated in MESA?
- Do you think that being in MESA has given you a greater sense of belonging to the department/university than students who are not participating? What gives you this impression?
- Do you have any recommendations on how the MESA program might be improved in the future?

IV. RESULTS AND DISCUSSION

Students visiting the MEP office and the MPE study room are the number one combined activity of the MPE program at over 5000 interactions. In Fig 1. The number of students participating in other MEP activities can be seen. The kickoff sessions have the largest attendance when the attendance is combined all four sessions per semester. The other activities have attendance in the mid 20's. A suspected reason based on the focus group (Shown later in this work.) for the lower turn out for these activities is that they need to be schedules around student's, class, work and family commitments.

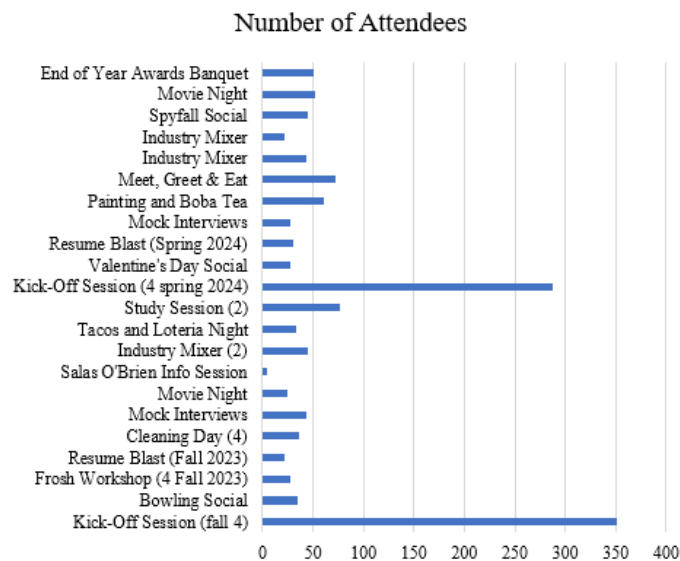


Fig. 1 MEP event attendance for AY 2023/2024.

As can be seen from table 1, the percentage of students who identify as Hispanic is approximately 45% per year and the of students who qualify for a Pell Grant is approximately 32% per year. The last year the percentage of Pell Grant students when up to 50%. Num HS is the number of students who identify as Hispanic, Num PG are the number of students who are Pell Grant Eligible, Num Members is the total membership of MEP. Retain Y1 is the number of students still enrolled at SJSU, and Retain/Graduate Y2 are the

number of students who are enrolled in SJSU, or who have graduated after two years in the program. F21 is the cohort starting in fall 2021.

Table 1: MEP Retention and Graduation Results.

	<i>Num HS</i>	<i>Num PG</i>	<i>Num Members</i>	<i>Retain Y1 (%)</i>	<i>Retain/Graduate Y2 (%)</i>
F21	224	156	487	94	89
F22	250	212	538	93	NA
F23	224	250	493	NA	NA

This compares favorably to the percentages of Hispanic and Pell Grant students in the College of Engineering which hovers in the mid 20% range for first time admits (Table 2) and varies from 14% to 30% across both categories for first-time transfer students (Table 3.) Num HS and Num PG have the same definition as before, except it is for the whole college. Num COE is the total number of students in the college that are first time admits or first-time transfers. RT Y1, Y2 is retention or graduation percentage for Hispanic (HS), Pell Grant (PG), or all college (COE). Note: These tables cannot be used to compare the MEP students directly with the college results because the MEP program has students from all levels participating and the college data is looking at first-time admits and first-time transfers only.

From tables 1, 2 and 3 it can be seen that students who participate in MEP have a higher or equal retention/graduation rate than the Hispanic, Pell Grant, and general college of engineering population. In other words, MEP serves a higher risk population than most of the college of engineering, yet has better outcomes.

Table 2: Retention and Graduation Rates for first time admits for the College of Engineering.

	<i>Num HS</i>	<i>Num PG</i>	<i>Num COE</i>	<i>RT Y1 HS (%)</i>	<i>RT Y2 HS (%)</i>	<i>RT Y1 PG (%)</i>	<i>RT Y2 PG (%)</i>	<i>RT Y1 COE (%)</i>	<i>RT Y2 COE (%)</i>
F21	246	256	1006	76	68	82	75	85	78
F22	181	205	732	81	86	NA	NA	88	NA
F23	239	233	835	NA	NA	NA	NA	NA	NA

Table 3: Retention and Graduation Rates for first time transfer students for the College of Engineering.

	<i>Num HS</i>	<i>Num PG</i>	<i>Num COE</i>	<i>RT Y1 HS (%)</i>	<i>RT Y2 HS (%)</i>	<i>RT Y1 PG (%)</i>	<i>RT Y2 PG (%)</i>	<i>RT Y1 COE (%)</i>	<i>RT Y2 COE (%)</i>
F21	145	238	648	88	82	89	85	87	81
F22	87	136	602	94	85	NA	NA	87	NA
F23	121	130	437	NA	NA	NA	NA	NA	NA

As can be seen in tables 4 and 5 the percentage of Hispanic and Pell grant students are 8% and 15% respectively for the fall 2023 for first time admits and first-time transfer students. The population is too low the other semesters to conduct a meaningful analysis. The MEP retention rates are comparable to the retention rates seen in the Hispanic, Pell grant and general population of the computer science department. The higher retention rates of the CS department are thought to be due the higher entrance requirements due to impaction.

Table 4: Retention and Graduation Rates for first time admits for the Computer Science department.

	<i>Num HS</i>	<i>Num PG</i>	<i>Num CS</i>	<i>RT Y1 HS (%)</i>	<i>RT Y2 HS (%)</i>	<i>RT Y1 PG (%)</i>	<i>RT Y2 PG (%)</i>	<i>RT Y1 CS (%)</i>	<i>RT Y2 CS (%)</i>
F21	<10	37	132	100	75	92	89	97	94
F22	<10	30	134	86	97	NA	NA	98	NA
F23	23	41	264	86	87	NA	NA	NA	NA

Table 5: Retention and Graduation Rates for first time transfer students for the department of Computer Science.

	<i>Num HS</i>	<i>Num PG</i>	<i>Num CS</i>	<i>RT Y1 HS (%)</i>	<i>RT Y2 HS (%)</i>	<i>RT Y1 PG (%)</i>	<i>RT Y2 PG (%)</i>	<i>RT Y1 CS (%)</i>	<i>RT Y2 CS (%)</i>
F21	<10	37	113	94	91	89	85	94	92
F22	<10	23	104	94	85	NA	NA	96	NA
F23	18	59	210	NA	NA	NA	NA	NA	NA

Insight into the causes of the excellent retention and graduation results of MEP members can be found in the results of the focus groups. The summaries of the combined focus groups are given in the reset of the results and discussion section.

Important considerations for joining MEP were: networking, internship opportunities, industry events, meeting new people/making friends, in an engineering-related club, and receiving mentoring and guidance.

In Year 2, students might have known more about MEP ahead of time, possibly from social media, because “the resources that MEP can provide” and the events that MEP social media posts described were cited as reasons they wanted to join MEP. In both years’ focus groups, students described the application process as “pretty easy,” and they were able to cite the eligibility requirements for membership.

In terms of meeting with MEP peer mentors, mentees indicated that they knew they should meet with their mentor three times per semester, and they generally did so (although commuter students found this more difficult). They described the meetings as friendly and helpful, as mentors provided class/program advice and information about resources or upcoming events.

Due to the large number of peer mentors in this year’s focus groups, we heard both sides of peer mentoring, both mentor and mentee. Mentors indicated that they could be assigned many mentees, but they were able to meet with each the required number of times, and more, if the mentee wanted to. Sometimes, they said, a mentee might not want or be able to meet with them, and they could not force them to do so. Mentors also described a delay in matching new MEP members to mentors due to new software. Next year they plan to return to “our more effective Spartan Connect.”

From the mentee point of view the students understood that peer mentorship was a MEP requirement and some mentees met more often than the required number of meetings. They found peer mentors helpful. The topics of discussion in peer mentor sessions included: internships, which classes to take, time management, navigating college generally, and other clubs/organizations on campus that mentees might be interested in. Additional topics that were mentioned in included connections to other students or alumni who could help them, mentors acting as a sounding board for student ideas or applications, and mentors providing emotional support (e.g., dealing with imposter syndrome).

With respect to MEP activities and resources, focus group students in both Year 1 and Year 2 found the following to be helpful: the resume blasts, industry mixers, mock interviews, and the study room. In Year 1, students singled out the whiteboard in the study room as especially helpful; in Year 2 they singled out the safety of the room and the availability of lockers for commuters. MEP activities and resources mentioned only in Year 2 focus groups include professional development (industry tours), course taking advice at registration, job fairs, and the MEP award ceremony.

In both study years, scheduling has been found to be an issue: commuters and students who work have a difficult time participating in events, particularly the social events. An issue emerged in the Year 2 focus groups due to the large number of peer mentor participants: students who RSVP for a mock interview but do not show up. Mentors themselves have been

interviewed in such situations so that industry professionals are not left without someone to interview.

Program participation helped students in their academic programs. Regarding whether MEP has helped students in their academic programs, students in focus groups from both study years indicated that it had helped them to have MEP friends to study with and that being in MEP has helped them learn to remain calm even if they're not doing well at the moment. In Year 1, students also cited navigating the transfer from community college, receiving help accessing resources, and remembering to have a social life as elements of MEP that were beneficial to their academic performance. In Year 2, students cited MEP career readiness activities that prepared them for a career readiness class, learning how to register for a summer course at a community college, and adopting the study ethic of other MEP members.

One recommendation was common to both years' focus groups: to schedule social events at times and in places that can include commuter students. Recommendations from the Year 2 focus group include ways to make the study room area more inviting: board games, hot water, and a couch. Students also realize that because MEP is growing, more physical space is needed for studying and for peer mentoring.

Overall, students join MEP for various reasons, but mostly for academic and career information and resources, as well as the camaraderie. It was not difficult to apply, but for some, especially commuters and students who work, it has been difficult to participate to the extent expected or that they would like. MEP peer mentors appear to have heavy caseloads but neither mentors nor most mentees had too much trouble scheduling mentoring sessions (again, commuters and those who work were the exceptions). The other elements of MEP, however, have been difficult to schedule, partly due to the pandemic (which is waning as a reason), and partly to the vastly different schedules of all students, mentors, and industry professionals. This year, students were aware of the growth of MEP and that it is outgrowing its space. They recommended expanding their space and adding a few comfort elements. Perhaps most importantly, students appreciate the camaraderie, study ethic, and social and emotional support provided by MEP. As one student said, **"If it wasn't for MEP, I wouldn't be an engineering major still."**

V. CONCLUSIONS

As can be seen the MEP program is working to help Hispanic and Pell grant students achieve better or comparable retention and graduation rates when compared to the population of the college of engineering. It is more difficult to analyze results for commuter science students owing to small population of computer science students in the target demographics.

Now that the data from the two focus groups has been analyzed a survey instrument will be implemented to get a

greater response rate in order to better study student perceptions of the MEP program.

Another study will track student participation in the MEP activities and look for trends in grade point average (GPA), retention and graduation rates.

It might be difficult to show improvement in grade point average (GPA), retention and graduation rates over the lifetime of the grant, because the MEP program at SJSU has been active for at least 10 years before the start of the grant. The only way forward is to increase the number of students participating in the MEP program.

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