

# Differences in Mental Health between Students in a Jointly Offered Computer Engineering Program and the two Home Departments

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**Abstract**—This Research Work-In-Progress Paper explores potential causes of measured differences in mental health between students in a joint Computer Engineering Program and students in the two home departments (Electrical Engineering and Computer Science). California Polytechnic State University (Cal Poly) currently runs its Computer Engineering Program (CPE) as a joint offering of the Electrical Engineering (EE) and Computer Science and Software Engineering (CSSE) Departments. The curriculum for this program is made up of roughly 50% computer science courses and 50% electrical engineering courses. With the exception of a single senior level capstone course, all CPE courses are also available to (and in many cases required for) students from the two home departments. As a result of this blended curriculum, it has long been assumed that CPE students would have a similar experience and a similar level of mental wellness to their peers in EE and CSSE. A recent study conducted at Cal Poly, however, indicates that CPE students are substantially more likely to screen positive for risk of Serious Mental Illness (SMI) than their peers. This study uses qualitative interviews with CPE, EE, and CSSE students try to determine potential stressors unique to each program. This study also delves into the quantitative survey data to look for population specific trends that may be feeding into this result.

## I. INTRODUCTION

As part of a recent study into the prevalence of mental health and wellness issues in engineering students, a group of researchers at Cal Poly San Luis Obispo (Cal Poly) discovered that on one key indicator of mental health issues, the Kessler 6—a widely-used short scale that screens for the presence of non-specific psychological distress [1]—students in Computer Engineering (CPE) were significantly more likely to suffer from unspecified psychological distress than their peers in any other engineering major [2]. This result is particularly surprising given that at Cal Poly San Luis Obispo, Computer Engineering is run as a joint program between Electrical Engineering (EE) and Computer Science and Software Engineering (CSSE).

The Computer Engineering program at Cal Poly San Luis Obispo draws half of its courses and faculty from the EE department, and half from the CSSE department. Additionally, roughly an equal number of tenure/tenure track faculty from CPE and EE have joint appointments with in the CPE area. Despite this, 50% of respondents in CPE screened positive for high risk of mental illness on the Kessler 6 scale, while only 38% and 41% of CSSE and EE students respectively screened positive on this measure.

To explore potential reasons for this discrepancy, this paper takes a two-pronged approach. In section III, we

analyze the underlying survey data and demographics of respondents from CPE, CSSE, and EE to determine if there are any confounding factors or trends in the respondent population that can explain these results. Then in Section IV, we discuss the design and preliminary results of a survey of student perceptions on the differences of mental health and wellness between the programs. Finally, the paper concludes in Section V.

## II. BACKGROUND

Little work has been done specifically to mental health and wellness of engineering students specifically. There is, however, a substantial body of work exploring the mental health of higher education students in general.

Over the past several years, an increasing number of higher education students have been diagnosed with mental health conditions leading to what some are calling a “mental health crisis” [3], [4], [5]. As a result of this crisis, suicide is now the second leading cause of death among college students [6].

For other students, mental health problems can lead to decreased academic performance. A study from 2009 linked depression and anxiety to lower overall GPA [7]. Also, a recent study of engineering students has shown a correlation between mental health and poor academic performance [8].

## III. SURVEY POPULATION FACTORS

Previous work studying the prevalence and types of mental health issues of engineering students at Cal Poly San Luis Obispo has shown that on the Kessler 6 scale for psychological distress, CPE students were significantly more likely to screen positive than their peers in EE or CSSE [2]. As shown in Figure 1, however, CPE students do not screen substantially higher than EEs or CSSEs for any specific mental health condition. Therefore, it is possible that there were other confounding factors in the respondent data influencing these results.

The study itself [2] was sent to all Cal Poly engineering majors with an active school email address, and managed a response rate of 16%. The study was comprised of the Kessler 6, PHQ [9], PC-PTSD [10], and CAGE-AID [11] instruments to screen for depression, anxiety, eating disorders, drug and alcohol abuse, post-traumatic stress disorder and generalized psychological distress. The survey also collected significant demographic information about the respondents.

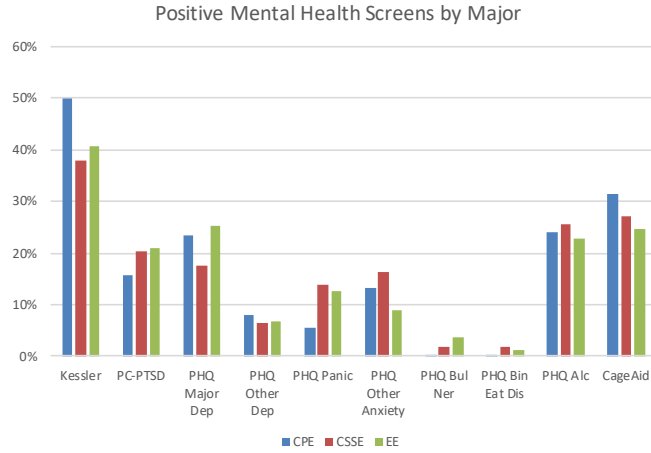


Fig. 1. Positive screen rates on various mental health surveys. In addition to generalized psychological distress, the study also looked for incidence of post-traumatic stress disorder (PTSD), major depressive disorder, other depressive disorders, panic disorder, other anxiety disorders, Bulimia Nervosa, binary eating disorder, alcohol abuse, and substance abuse respectively. PHQ = Public Health Questionnaire

TABLE I  
COMPARISON OF DEMOGRAPHICS OF RESPONDENTS FROM CPE, CSSE, AND EE MAJORS. STATISTICALLY SIGNIFICANT DIFFERENCES ( $P \leq 0.05$ ) BOLDED.

	CPE	CSSE	EE	$P$ CPE vs CSSE	$P$ CPE vs EE
Responses	60	120	87		
Diagnosed with MH condition (%)	12	18	14	0.67	0.70
Male (%)	80	63	75	<b>0.016</b>	<b>0.019</b>
Heterosexual (%)	82	83	88	0.91	0.87
White (%)	65	55	52	0.22	0.15
Average year in prog.	3.1	2.8	2.5	0.10	<b>0.008</b>
Average age	20.7	20.4	21.2	0.22	0.31
Confidence in grad. in eng. (5 highest)	4.38	4.56	4.62	<b>0.045</b>	<b>0.046</b>

To check for confounding factors, we analyzed the demographic data for CPE, CSSE, and EE students. We ran T-Tests comparing CPE vs. CSSE responses and EE vs. CSSE responses to check for differences. Any result with a  $P \leq 0.05$  was considered significant. A summary of results from this review is shown in Table I.

One immediately apparent result from our analysis of respondent data is that there were far fewer CPE respondents than EEs or CSSEs. There are roughly an equal number of EE and CPE students enrolled at Cal Poly San Luis Obispo (CSSE is a larger program as it encompasses both Computer Science and Software Engineering majors), indicating that small proportion of the CPE population participated in the survey than their peers in other majors. This could have skewed the results of the survey if the CPE students who chose to respond happened to be more distressed than the rest of their peers in the major. Looking into the demographic

TABLE II  
COMPARISON OF RESULTS OF BPNS SCALE FOR REACH MAJOR. EACH MEASURE IS ON A SCALE OF 1–5 WITH 5 BEING THE HIGHEST (E.G. MOST SATISFIED). THE ONLY STATISTICALLY SIGNIFICANT RESULT IS THAT CPE AND CSSE STUDENTS HAVE STATISTICALLY EQUIVALENT FEELING OF “COMPETENCE SATISFACTION.”

	CPE	CSSE	EE	$P$ CPE vs CSSE	$P$ CPE vs EE
Autonomy Sat	3.52	3.60	3.53	0.57	0.66
Autonomy Frust	2.83	2.81	2.82	0.89	0.88
Relatedness Sat	3.58	3.79	3.70	0.19	0.20
Relatedness Frust	2.23	2.06	2.12	0.28	0.29
Competence Sat	3.58	3.49	3.45	<b>0.95</b>	0.86
Competence Frust	2.85	2.89	2.92	0.82	0.67

data, the CPE respondents were also significantly more likely to be male than their counterparts in EE and CSSE, and were further along in their program than their colleagues in EE.

The analysis also showed that CPEs were statistically less confident in their belief that they would ultimately graduate with a degree in engineering. Unfortunately, it is hard to say definitively what this measure means: on the one hand, lower confidence in graduation could possibly cause higher levels of nonspecific psychological distress (the Kessler 6 screen). It is also possible, however, that higher levels of nonspecific psychological distress could cause students to be more pessimistic about their prospects for graduation. So while this result is certainly something that should be explored further, it does not provide a clear explanation for why CPE students screen higher on the Kessler 6 than their peers in other programs.

In addition to demographic data, we also analyzed respondents' responses to the Basic Psychological Needs Satisfaction and Frustrations scale (BPNS) [12] to determine whether there was any significant differences in motivation as viewed in the framework of Self-Determination Theory [13]. The instrument measures to what extent an individual's need for autonomy, relatedness, and competence are satisfied or frustrated with regards to their chosen program of study. This data was collected at the same time as the data in our previous mental health study [2], but had not been previously analyzed or published. The results of this analysis are shown in Table II.

As seen in Table II, there are no statistically significant differences between CPE students and their peers in CSSE or EE on any of these measures. In fact, the only statistically significant result found was that CPE and EE students have statistically identical feelings of competence satisfaction.

As part of our analysis, we also analyzed responses for individual questions on the BPNS instrument. This analysis showed no statistically significant differences in responses among student groups.

Taken as a whole, the data does not clearly indicate whether the substantially higher positive screen rate for CPE students on the Kessler 6 instrument is the result of an actual

TABLE III  
SURVEY QUESTIONS FOR CPE STUDENTS. CSSE AND EE STUDENTS  
WERE PRESENTED WITH SIMILAR QUESTIONNAIRES ASKING TO  
COMPARE THEMSELVES AGAINST THE OTHER TWO  
PROGRAMS/DEPARTMENTS.”

Question
1) How do you think overall quality of life for CPE students compares to that of EE students?
1a) What factors do you think contribute to this?
2) How do you think overall quality of life for CPE students compares to that of CSSE students?
2a) What factors do you think contribute to this?
3) How would you rate your overall mental wellness?
4) Is there anything unique about CPE that you feel has an impact on your mental wellness?

difference in the mental health between student populations, or whether it was an artifact of methodology. On the one hand, there were significantly fewer respondents from the CPE program than from either of the two home departments. Also, on all of the other mental health and motivation screens CPE students did not have significantly different screening rates or responses than their peers.

On the other hand, respondents from CPE had a statistically less agreeable response to the statement “I believe I will graduate with a degree in engineering.” Whether or not this result is caused by, or correlated with the generalized psychological distress indicated by the Kessler 6 screen, it certainly points towards the idea that CPE students are struggling more than their peers in EE and CSSE. To further investigate this issue, we gathered qualitative data from students in each of the three programs/departments about their perceptions of mental wellness in their course of study. This preliminary data is presented in Section IV.

#### IV. STUDENT IMPRESSIONS

Section III showed that after a review of the previous mental health study, the higher incidence of generalized psychological distress screens for CPE students can not be fully explained by confounding factors. To try to get a better idea of whether CPE’s have lower overall mental wellness than their peers and what some possible causes might be, we sent an IRB-approved qualitative survey instrument to students in all three programs/departments. This study was administered as a follow-up over a year after the previous survey was completed. Also, since both surveys offered anonymity, there is no way to know what percent of students responded to both this instrument and the previous study.

This survey instrument is designed to get student impressions of how their program of study affects their mental wellness, and how they believe that differs from their impressions of other programs of study. The survey questions for CPE students is shown in Table III. For each question, the student was allowed to submit as much or as little as they would like into a free-response box.

As of writing, we received 91 student responses to the survey: 65 CPE, 18 CSSE, and 8 EE. As a condition of IRB

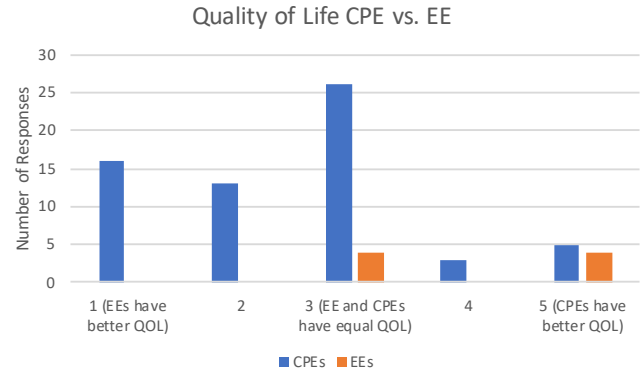


Fig. 2. Student impressions of Quality of Life (QOL) in EE vs. CPE. More EE data is being collected and will be in place by final draft.

approval, no survey questions could be required. Therefore, the number of respondents for each question can vary.

In analyzing respondent data, the qualitative responses to questions 1 and 2 lent to be mapped to a 5 point Likert-scale with 1 indicating the quality of life (QOL) in one major was better, and 5 indicating that the QOL of the other major is better (a score of 3 indicates no difference).

The result of this mapping is shown in Figures 2 and 3. In both cases CPEs tend to view students in the other major having a superior quality of life, however, CPEs tend to believe that students in CSSE have it the best. While some of these responses may stem from a “grass is always greener” distortion, the CSSE students tend to agree that CSSE students are better off. Additionally, in responses to questions 1a and 2a, CPEs give some fairly compelling reasons for their viewpoints. Sixteen of the 64 CPE respondents voice the complaint that the way the CPE program is structured, with half CSSE and half EE courses leaves students feeling like they’re pursuing a double major: getting the fundamentals of both subjects, without always getting into the depth or real-world application, and not seeing much overlap between the lessons learned from EE and CSSE courses. Additionally, many students complain that as part of the program, they are required to take some of the most notoriously difficult (“important” in instructor-speak) courses of both the EE and CSSE departments without the same level of preparation as their colleagues in these other departments.

Finally, several students complain that as CPE students they suffer from the weaknesses of both home departments. Specific complaints include the long-prerequisite chains for EE classes interacting with the low availability of seats in required CSSE classes leading to scheduling nightmares. Additionally, some students complain that courses in either department (EE and CSSE) prioritize the needs of the home department students, leaving CPEs with few course options that leverage their skill-set. As an instructor for both EE and CPE students, it can be quite difficult to fully engage students from all backgrounds in EE/CPE cross-listed courses [14].

Many of these reason’s for why CPE’s felt students in other programs have a better quality of life were also

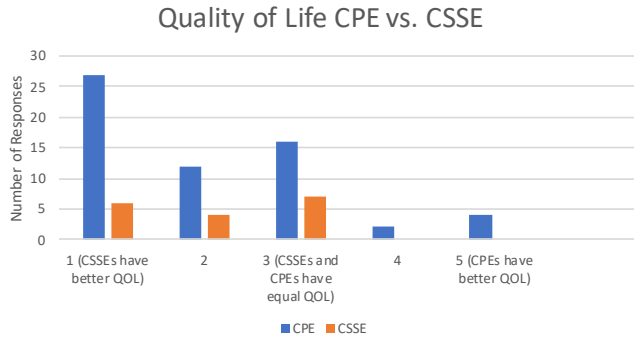


Fig. 3. Student impressions of Quality of Life (QOL) in CSSE vs. CPE. More CSSE data is being sought for the final draft.

reiterated in response to question 4, “Is there anything unique about CPE that you feel has an impact on your mental wellness?” Five of the 64 CPE respondents made specific reference to the idea that the way the CPE program is structured, they spend a large amount of time learning fundamentals of CSSE and EE without the opportunity to explore any given topic to a sufficient depth. Another 16 students mentioned the heavy course workload required by the CPE program, with many specifically referencing the need to learn both EE and CSSE concepts and mindsets as a particular stressor. Finally, eight students mentioned the challenge of dealing with two home departments and the limited amount of CPE-specific administrative support and scholarship opportunities as unique factor contributing to stress in the Computer Engineering program.

Taken together, these complaints seem to indicate that many CPE students feel a lack of a coherent program identity in the course of their study. Many students appear to view CPE as more of an experience in double-majoring than a separate degree program. As one respondent volunteered:

CPE has made me a “Master of None” in a way. I’ve been incredibly fortunate to have gained experience in everything from analog hardware all the way up to web development, and virtually everything in between, and my resume and credentials show for it. However, what’s particular about my scenario is that I still don’t really know what major focus I want to go into, software or hardware. This has made me feel down on myself, as friends in EE and CSSE has a much more directed curriculum path, and thus seem to have less of a sense of doubt. I wish there were more opportunities within the curriculum, aside from three technical electives, that gave CPE students more of an opportunity to explore a field in which they are interested.

For some students, this lack of identity gets projected into the future, with one student anticipating that majoring in CPE will lead to a “lack of specific knowledge except in lower-level systems, which have far less job opportunities (it feels like).” Without a clear sense of focus, community, or even future prospects, it makes sense that CPE students

may be more likely to suffer from general psychological distress than their peers in the home departments. This lack of ‘relatedness’ is reflected in the quantitative survey data shown in Table II albeit with a statistical p-value of 0.2.

## V. CONCLUSIONS

During an earlier study on mental health in engineering students, we discovered that CPE students appeared to screen higher for generalized psychological distress than any other measured program or department. This result was particularly surprising since CPE is offered as a joint program between the Electrical Engineering Department and the Computer Science and Software Engineering department at California Polytechnic State University.

To determine possible reasons for this discrepancy, we first looked at the demographics of survey respondents, as discussed in Section III. While there were significantly fewer CPE respondents than respondents from EE or CSSE, that alone was not enough to fully discount the higher positive Kessler 6 screen rate observed among CPE students. Additionally, a closer look at the data revealed that CPE students were significantly less confident in their prospects of graduating in engineering. This result provided a further indication that our CPE students might be facing unique challenges.

To get a possible student perspective into this issue, we then surveyed CPE, CSSE, and EE students about their impressions of mental health and quality of life across the majors, as discussed in Section IV. The preliminary results showed that CPEs generally believe students in either of the home departments have a higher quality of life than CPE students. Delving deeper into the CPE responses, it seems that many students view CPE as lacking a program identity: taking courses from two home departments left several students feeling like “master[s] of none,” and several students noted that being in a joint program left them in the unenviable position of navigating the enrollment policies and teaching philosophies of both home departments. While certainly a significant number of respondents expressed positive views of their quality of life and mental health in the program, or at least expressed that they did not believe CSSEs or EEs had things any better, there is a very real possibility that the unique challenges and lack of cohesive program identity experienced by CPE students has led to an increase in overall generalized psychological distress for these students.

If this is the case, then these results may certainly have broad implications for joint degree programs across engineering institutions. Especially as interdisciplinary degree options become more common, programs may wish to pay closer attention to how their students are coping with the challenge of managing studies across multiple departments. Indeed, the data presented here strongly indicate the need for studies into whether and to what extent the structure and administration of joint programs of studies can create unique challenges for student wellness.

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