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Enabling Resilient Educational Support Network during COVID-19 Pandemic for Undergraduate and Second Career Seeking Students

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Abstract

During times of local and national quarantine due to the COVID-19 pandemic, universities had to close campuses and expediently convert operations and services from face-to-face to virtual learning environments, including virtual classrooms, learning communities, offices, and meeting/advising rooms. Many engineering faculty and students experienced personal, technical, and psychosocial challenges associated with this dramatically altered reality, which may have significant and unprecedented effects on their personal and academic lives. The current study presents results from a needs assessment survey examining the perceptions of 157 engineering students majoring in mechanical and aerospace engineering about the strengths and challenges exhibited by their professors/instructors as a result of the COVID-19 pandemic. Additionally, we describe the instructional efforts and approaches taken by faculty to resolve the practical challenges because of the pandemic. Student perceptions of faculty effectiveness and support were examined by analyzing means and frequencies of survey items. Results revealed that on average, engineering students were positive in their perceptions of the effectiveness and resources/support provided by their professors/instructors during the COVID-19 pandemic. Qualitative data from an open-ended question were coded and quantified. The theme that emerged most frequently reflected engineering students' need for professors/instructors to demonstrate flexibility/leniency with assignments, quizzes, exams, and deadlines. This short paper provides critical assessment of the gaps in institutional services and resources and provide the required feedback, while informing the institution and the research community about the ways to develop a resilient support network for engineering students in the times of crisis. Future work will consider how student responses change under the altering societal and work/academic conditions with or without COVID-19 pandemic being present at that time. Results from the current study also provide recommendations for effective online instruction in the future.

Keywords: *Needs Analysis, Learning Technology, Engineering Students*

Introduction

During times of local and national quarantine due to the COVID-19 pandemic, universities had to close campuses and expediently convert operations and services from face-to-face to virtual learning environments, including virtual classrooms, learning communities, offices, and meeting/advising rooms [1]. Technological tools and virtual learning platforms, which facilitated virtual course delivery and learning, allowed universities and students to complete their spring semesters [2]. However, many engineering faculty and students experienced personal, technical, and psychosocial challenges associated with this dramatically altered reality, which may have significant and unprecedented effects on their personal and academic lives [3-4].

The COVID-19 pandemic required prompt and bold action by engineering departments and faculty to (1) identify and understand the needs and challenges experienced by engineering faculty and students [5], and (2) redesign and implement innovative efforts to convert the traditional engineering learning environment into an effective virtual learning environment. Consequently, in this paper, we present results from a needs assessment survey examining the perceptions of 157 engineering students in majoring in mechanical and aerospace engineering about the strengths and challenges exhibited by their professors/instructors as a result of the COVID-19 pandemic. Additionally, we describe the instructional efforts and approaches taken by faculty to resolve the practical challenges because of the pandemic.

Methods

The needs assessment survey was designed to evaluate various sources of stress among the engineering students due to changes in their academic environment because of the COVID-19 pandemic, including advising and teaching approaches, technology requirements, as well as accessibility to services and supports. The survey was voluntary, anonymous, and administered through Qualtrics to capture students' perceptions at the end of the spring 2020 semester after the closing of campus and the restructuring of classes to a completely virtual learning environment. For purposes of this paper, we focused on responses by 157 undergraduate students majoring in mechanical and aerospace engineering to a subset of 11 survey items using a 5-point Likert scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*) and one open-ended question assessing the extent to which these students (a) felt supported and were provided resources by their professors/instructors to adapt to school changes due to the COVID-19 pandemic, (b) perceived their professors/instructors as effective academic leaders, and (c) needed additional help and support from their professors/instructors (Figure 1) [6].

Due to the imposed COVID-19 restrictions, the second half of the semester across the engineering college was conducted through virtual delivery mode. This included use of video conferencing for lectures, laboratory classes, and student advising. In the case of lecture classes, the most common way of delivery was through the synchronous virtual instruction, while laboratory sessions were a combination of synchronous (e.g., live Zoom lecture) and asynchronous (e.g., short instructional videos) virtual instruction. The recorded video lectures were made available to the students via on-line platform (Blackboard) for the rest of the semester. Students were encouraged to participate in the online classes either live or watch the lectures on demand. All homework and assignment submissions were done virtually via the Blackboard portal.

1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree

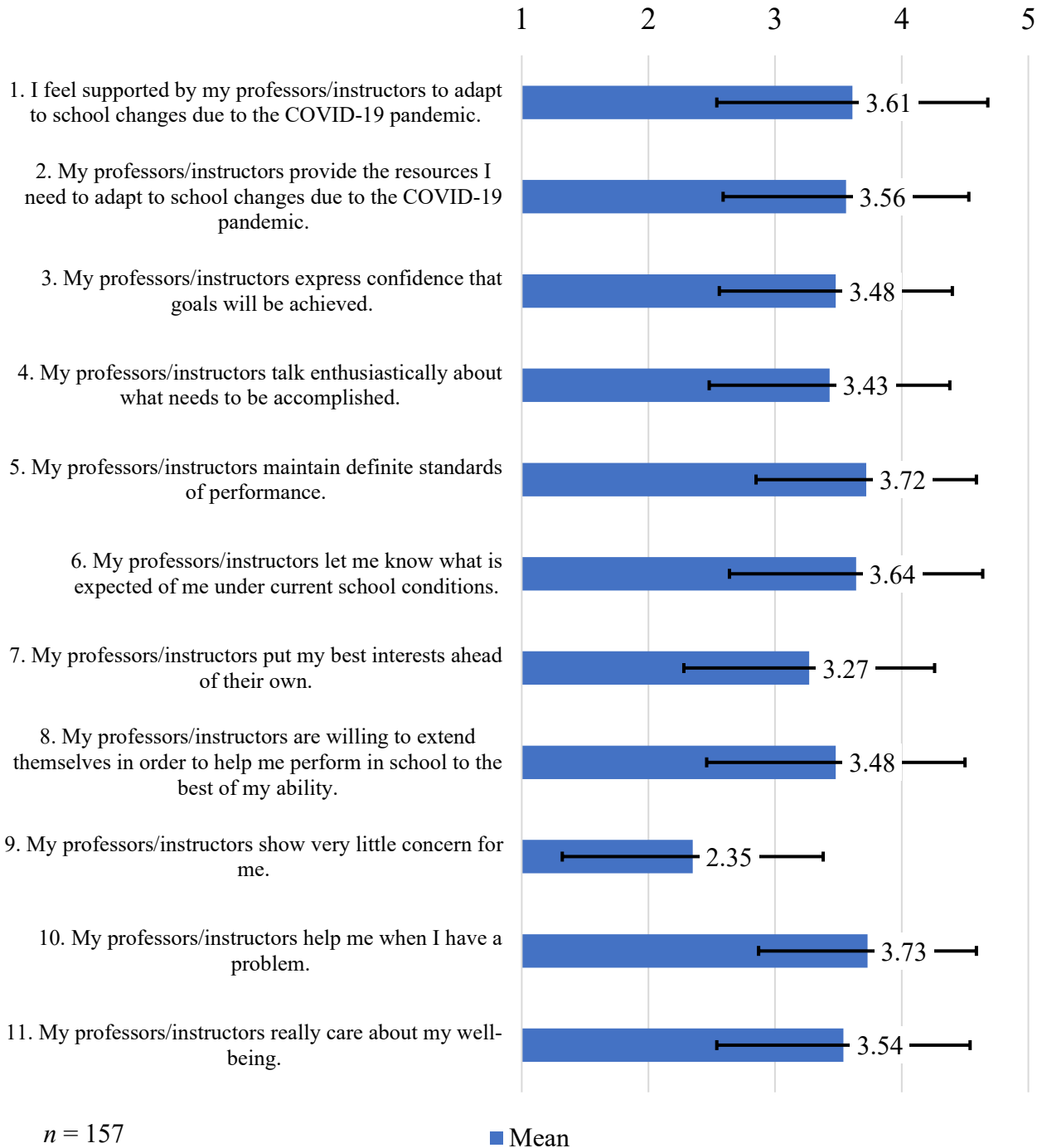


Figure 1. Means and Standard Deviations for Professor / Instructor Support Items

Preliminary Results & Discussion

Student perceptions of faculty effectiveness and support were examined by analyzing means and frequencies of survey items. Positively worded item means ranged from 3.27 ($SD = 0.99$) for “My professors/instructors put my best interests ahead of their own”) to 3.73 ($SD = 0.86$) for “My professors/instructors help me when I have a problem”), indicating that, on average, engineering students were positive in their perceptions of the effectiveness and resources/support provided by their professors/instructors during the COVID-19 pandemic (see Figure 1). This was consistent with the relatively low mean of responses to the negatively worded item – “My professors/instructors show very little concern for me” ($M = 2.35$; $SD = 1.03$, see Figure 1).

Examination of frequencies in Table 1 revealed that the majority of engineering students agreed or strongly agreed that their professors/instructors maintained standards of performance (70.1%), helped students with problems (66.9%), were supportive (65.6%), stated clear expectations (65%), provided resources (59.9%), cared about students’ well-being (57.3%), expressed confidence (54.8%), were willing to extend themselves (54.1%), and talked enthusiastically about goals (51%). Conversely, only 36.9% of students agreed or strongly agreed that their professors/instructors put students’ best interests ahead of their own. Furthermore, approximately one out of seven students (14.6%) agreed or strongly agreed that their professors/instructors showed little concern for them, and one out of eight students (12.7%) disagreed or strongly disagreed that their professors/instructors cared about their well-being.

Qualitative data from responses to the question “What action, if any, could your professors/instructors take that would both help you to complete your schoolwork effectively AND support your wellbeing, under current school conditions?” were coded, quantified, and are presented in Table 2. The theme that emerged most frequently reflected engineering students’ need for professors/instructors to demonstrate flexibility/leniency with assignments, quizzes, exams, and deadlines. Additionally, participants also reported needs for clearer instructions/expectations, more responsive and available professors/instructors, higher quality of online instruction, and greater empathy and understanding of what students were experiencing during the COVID-19 pandemic.

Overall, our results suggest that the majority of surveyed students considered their Engineering professors/instructors to be supportive, helpful, and considerate during the time of COVID-19 outbreak and the ensued dramatic changes in university policies, protocols, and practices. However, the relatively moderate means (< 4 on a 5-point scale) and large standard deviations as illustrated in Figure 1 along with qualitative comments suggest that faculty can make improvements in how they relate to their students (e.g., demonstrate empathy, confidence, and enthusiasm) and serve their needs (e.g., place students’ needs first, show flexibility and responsiveness) to promote student academic success and well-being.

Table 1: Frequency of Responses for Professor / Instructor Support Items (n = 157)

Item	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. I feel supported by my professors/instructors to adapt to school changes due to the COVID-19 pandemic.	11 (7.0%)	12 (7.6%)	31 (19.7%)	77 (49.0%)	26 (16.6%)
2. My professors/instructors provide the resources I need to adapt to school changes due to the COVID-19 pandemic.	6 (3.8%)	15 (9.6%)	42 (26.8%)	73 (46.5%)	21 (13.4%)
3. My professors/instructors express confidence that goals will be achieved.	4 (2.5%)	19 (12.1%)	48 (30.6%)	70 (44.6%)	16 (10.2%)
4. My professors/instructors talk enthusiastically about what needs to be accomplished.	2 (1.3%)	27 (17.2%)	48 (30.6%)	62 (39.5%)	18 (11.5%)
5. My professors/instructors maintain definite standards of performance.	2 (1.3%)	15 (9.6%)	30 (19.1%)	88 (56.1%)	22 (14.0%)
6. My professors/instructors let me know what is expected of me under current school conditions.	3 (1.9%)	23 (14.6%)	29 (18.5%)	75 (47.8%)	27 (17.2%)
7. My professors/instructors put my best interests ahead of their own.	7 (4.5%)	21 (13.4%)	71 (45.2%)	39 (24.8%)	19 (12.1%)
8. My professors/instructors are willing to extend themselves in order to help me perform in school to the best of my ability.	6 (3.8%)	20 (12.7%)	46 (29.3%)	62 (39.5%)	23 (14.6%)
9. My professors/instructors show very little concern for me.	34 (21.7%)	61 (38.9%)	39 (24.8%)	19 (12.1%)	4 (2.5%)
10. My professors/instructors help me when I have a problem.	3 (1.9%)	9 (5.7%)	40 (25.5%)	81 (51.6%)	24 (15.3%)
11. My professors/instructors really care about my well-being.	8 (5.1%)	12 (7.6%)	47 (29.9%)	68 (43.3%)	22 (14.0%)

Table 2: Frequency of Qualitative Recommendations for Professors / Instructors

Question: What action, if any, could your professors/instructors take that would both help you to complete your schoolwork effectively AND support your wellbeing, under current school conditions?

Category	Explanation	Count
Flexibility/Leniency	Participants indicated a need for flexibility / leniency regarding due dates and time allocated on assignments, quizzes, exams, etc. This also includes grading assignments on completion versus correctness and canceling or modifying final exams.	28
Clear Instructions/Expectations	Participants indicated a need for clear guidance on what is expected from them with the switch to virtual learning and explicit instructions and due dates for assignments, quizzes, exams, etc.	13
Responsiveness/Availability	Participants indicated a need for timely responses to emails, posting of grades, and dissemination of course material.	13
Online Instruction Quality	Participants indicated a need for quality Zoom lectures (i.e., interesting, appropriate length, quality audio / visual), class resources (i.e., lecture slides / recorded lectures posted online), and assistance collaborating with other students to work on assignments and prepare for exams. Participants also indicated a need for professors / instructors to maintain the quality of their in-person teaching while providing online instruction.	13
Empathy	Participants indicated a need for greater empathy and understanding from professors / instructors regarding their experiences during the COVID-19 pandemic and disruption to their normal learning routine, including changes in access to technology (i.e., computers, WiFi, etc.) and new family demands.	12
No Indication of Need/Positive Response	Participants indicated that their professors / instructors were doing an adequate to good job with helping them complete their schoolwork effectively and support their wellbeing under the current school conditions.	7
No Responses	Participants left this question blank and did not provide any recommendations to help complete schoolwork effectively and support wellbeing under current conditions.	84

Implemented Educational Approaches and Supports

Student challenges because of school policy changes due to the COVID-19 pandemic included work-school conflict, internet availability and connectivity off campus, health concerns, and personal hardships. To appropriately address the challenges of the remote learning environment, engineering faculty worked with students on a case-by-case basis to ensure equitable access to academic resources and to support student learning, including offering regular virtual office hours and providing flexibility in submission of course assignments.

On-line delivery of laboratory classes posed a major challenge due to inability to conduct the labs in person. We used different strategies and approaches to adapt to the new realities. For example, we developed a series of short 5-minute-long instructional videos with the graduate teaching assistants for a materials lab. These instructional videos described various steps, such as sample preparation, the experimental setup used to conduct the mechanical testing, data reduction, and analysis of the results. Students were introduced to the learning material by the instructor who demonstrated how to conduct the test in the lab remotely. Even though students did not have the physical access to the experimental set-up, the proposed combination of the step-by-step instruction supported by the instructional videos proved effective in achieving learning outcomes defined by the ABET system, which were consistent with the learning outcomes in the pre-pandemic era. For other laboratory-related work, such as the Senior Design year-long projects, students worked closely with the faculty advisor on how to follow the college-approved plan of conducting work in the lab. This included wearing face masks at all times and regular use of hand sanitizers and gloves when working with commonly shared equipment. Since labs were operated at a significantly reduced capacity, allowing only between 4-8 students in the lab depending on the square footage, the Senior Design groups were split into sub-groups of up to four students and worked in the lab on different days of the week. In some instances, design and fabrication work could be conducted remotely by using students' own workspaces. Proper arrangements were made for completing school assignments off campus by accessing the university computers remotely via VPN connections and by shipping materials and supplies directly to the student's residence. The combination of these approaches and strategies allowed students involved in the undergraduate research and Senior Design projects to still benefit from experiential learning by engaging in hands-on activities in a laboratory setting, while ensuring their safety.

Future Work

This short paper provides a preliminary assessment of student perceptions of Engineering faculty effectiveness and support during the outbreak of COVID-19 and describes several instructional strategies and approaches adopted to address challenges in online learning. The student feedback provides directions to how to build academic support networks to mitigate the adverse effects of the pandemic. Results from the current study also provide recommendations for effective online instruction under pandemic conditions. Longitudinal needs assessment surveys and focus group interviews with engineering students and faculty will be conducted. The future work will consider how student responses change under the altering societal and work/academic conditions due to the COVID-19 pandemic. Future research will aim to understand the long-term effects of the COVID-19 pandemic on student engagement, burnout, and degree persistence and attainment.

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