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Recommended Citation

Marquez, E., & Garcia, S. (2022, August), IN-PERSON INSTRUCTION OR REMOTE LEARNING?: UNDERSTANDING STUDENTS' LEARNING EXPERIENCES DURING COVID-19 Paper presented at 2022 ASEE Annual Conference & Exposition, Minneapolis, MN. <https://peer.asee.org/41075>

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IN-PERSON INSTRUCTION OR REMOTE LEARNING?: UNDERSTANDING STUDENTS' LEARNING EXPERIENCES DURING COVID-19

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IN-PERSON INSTRUCTION OR REMOTE LEARNING?: UNDERSTANDING STUDENTS' LEARNING EXPERIENCES DURING COVID-19

Research attests that student success in engineering education is cultivated largely due to classroom environments, academic inclusion, and engagement in undergraduate research. It is further revealed that the social and academic fabric of the institution such as academic advising, peer tutoring, disability services, and outdoor recreational programs is essential towards fostering well-being, recruitment, retention, and student success. However, these studies were conducted in a period in which students experienced traditional face-to-face instruction. In the wake of COVID-19, most institutions responded by terminating in-person instruction, mandating to seek off-campus housing, and shifting to a fully remote context. As such, educators were challenged to reimagine and reconfigure course delivery for a period in which students were unable to utilize campus resources and engage in established educational campus practices. For the 2020-2021 academic year, a private university in Texas opted to operate a hybrid delivery format, which gave students the option of returning to campus and attend in-person instruction. In this research study, forty students enrolled in a Rigid Body Dynamics course were surveyed to explore their academic and/or personal experiences within in the context of this hybrid environment. The study sought to examine the differences experienced by students who attended in person instruction and those who participated in remote instruction. Eighty percent of the population attended in-person instruction and resided on or nearby campus, while twenty percent of the cohort remained fully online. The paper presents two student perspectives: 1) during the period in which courses were strictly delivered in a remote format, and 2) during the period in which students were afforded the opportunity to return to campus and partake in face-to-face instruction. Study findings revealed that remote instruction allowed students to be closer with family, however, it simultaneously generated distractions which hindered their ability to fully comprehend course material. For those students returning to campus, results indicate that less distractions were experienced, it was easier to pay attention, campus resources were utilized, and there was delight in engaging with people.

I. BACKGROUND AND MOTIVATION

Background

Research efforts attest that student success in engineering education is cultivated largely due to several factors such as classroom environments, academic inclusion, engagement in undergraduate research, and the social and academic fabric of the institution. According to the literature, classroom environment, which alludes to the tone, climate, or ambience influencing the setting, has a profuse impact on three aspects in engineering education: student learning, engagement, and success [19], [23], [24], [25], [26]. It is reported that educational success depends on the psychosocial aspect of the classroom, which is a combination of psychological factors and the social environment [20], [21], [22], [27], [28], [29], [30].

Student success, according to research incentives, is further cultivated by partaking in undergraduate research given its immediate and long-term benefits [2], [5], [7]. According to a survey conducted by Russell in 2006, 53% of all STEM majors are involved in some form of research activity throughout their undergraduate matriculation [1], [3]. Studies reveal that participating in undergraduate research venues is notably beneficial towards nurturing academic development and clarifying career options post-graduation [7], [8]. In a survey conducted by the

National Science Foundation (NSF), 88% of its respondents, which held undergraduate research positions, reported significant growth in structuring and conducting a research project, 83% expressed greater confidence in research and professional abilities, and 73% attested awareness of a graduate school environment [3], [4], [9]. These undergraduate research opportunities, according to Hurtado *et al.* [2], have further facilitated the decision of its participants to pursue STEM careers and Ph.D. studies post-graduation [14]. It is further reported that partaking in undergraduate research opportunities is considered an effective educational tool regarding the overall undergraduate experience [13], [14]. Such tool has proven to increase the pursuit of STEM degrees and graduate education for every ethnic group [15], [16], [17]. Bauer and Bennett further reported that participating in research venues improves skills such as speaking effectively, carrying out research assignments, and acquiring and interpreting data [18].

In a similar context, Pascarella & Terenzini, Tinto, and Thomas have argued that student success emerges in higher education when learners are integrated into the social and academic fabric of the respective institution [10], [12], [13]. Data suggest that having additional resources on campus such as peer tutoring, academic advising, personal and career counselling, and disability services may be beneficial [11]. For instance, it can assist disadvantaged students overcome potential lack of academic information, cultural capital, or academic preparedness [2], [12]. Bauman *et al.* further reported the likelihood of students using campus services [3]. Results indicate that three quarters of the participants were likely or very likely to utilize career counseling services, while half of the students mentioned the likelihood of using financial aid, time management workshops, and stress management resources [3].

Research further attests that campus outdoor recreation programs and facilities provide numerous benefits such as student recruitment, retention, and the opportunity to support academic programs. Andre *et al.* concluded that benefits such as lower levels of stress and anxiety, increased academic success, smoother transition to college, and better mental and physical health result from students utilizing campus outdoor recreation programs [1]. Further, it is well established that students' ability to cope with others in academic settings is significantly improved as a result of outdoor education experiences [1]. Cooley *et al.* observed an improvement in the students' perceived group-work skills as well as the attitude and confidence toward group work [1], [6]. Sibthorp *et al.* concluded that students found gratification in learning by using outdoor education resources, while Bell and Holmes reported higher learning outcomes on students participating in an outdoor adventure-based seminar course [4].

Motivation

In the wake of COVID-19, however, most institutions responded by terminating in-person instruction, mandating to seek off-campus housing, and shifting to a fully remote context. As such, educators were challenged to reimagine course delivery for a period in which students were unable to utilize campus resources and engage in established educational campus practices. Suddenly, well-established conditions that supported student success such as classroom environments, academic inclusion, engagement in undergraduate research, and the social and academic fabric of the institution were challenged.

To address the lack of accessibility to academic resources and campus practices during the outbreak of COVID-19 in the Spring 2020, various alternative pedagogical models emerged. Marquez and Garcia designed and implemented a model termed CIRE (acronym for Communication, Initiation, Reduction, and Extension). Based on its assessment, it was reported

that students exposed to the CIRE model were academically and personally satisfied with the implementation of the four practical strategies, which addressed the challenges associated with remote instruction and learning [24].

However, despite the effectiveness of several pedagogical methods and practices that emerged during the period of online instruction, numerous students attending a private university in Texas decided to return to campus in the Fall of 2020. The intention of this study is to understand why several students willingly returned to campus despite the safety challenges surrounding COVID-19. Particularly, this study aims to identify the academic elements lacking at home during the period of remote instruction.

II. PROPOSED WORK

For the 2020-2021 academic year, a private university in Texas opted to operate in a hybrid delivery format, which gave students the option of returning to campus and attend in-person instruction. It is imperative to mention that though students were allowed to return to campus, their attendance to in-person instruction was not mandatory on behalf of the administration, students were allowed to decide whether attending lecture session in-person or via Zoom was the best option due to COVID-19 safety. For those that opted to be in-person, classroom chairs/desk were arranged in a socially distant manner to conform to safety protocols.

This study sought to examine the differences experienced by students who attended in-person instruction and those who participated via a remote setting. The following academic elements were considered:

Element 1: Advantages and disadvantages of attending in-person instruction

A critical aspect in this study is to examine the advantages and disadvantages associated with attending in-person instruction. Although students returning to campus were not obligated to attend in-person instruction, there was a significant number who decided to return to the classroom. Thus, it is imperative to understand whether returning to the classroom represented a pleasant academic experience, which allowed students to gain academic success, or was a bit challenging regarding the COVID-19 situation. In addition, students may have returned to the classroom due to the academic advantages, and/or due to the social fabric and its benefits.

Element 2: Advantages and disadvantages of watching lectures via Zoom and being remote

After students were sent home during the Spring 2020 semester due to the emergence of COVID-19, in-person lectures transitioned to an online format. Thus, it is important to understand student's perspective regarding the advantages and disadvantages of online instruction. Several of the advantages may be related to non-academic benefits such as remaining at home, financial aspects, wellbeing, etc. While various disadvantages may be related to experiencing academic success, particularly, using campus resources or having study groups.

Element 3: Importance of being on campus and its resources

Another aspect of this study pertains to the need of being on campus. Since many students decided to return to campus for the 2020-2021 academic year despite the pandemic challenges, it is relevant to understand the motive. Particular interest arises in this study given that Pascarella *et al.* argued that student success emerges if all learners are integrated into the social and academic fabric of the institution [10], [12], [13]. Thus, it is critical to understand if peer tutoring, academic advising, personal and career counselling, and disability services influenced in the decision of returning to campus. The authors are also interested whether campus outdoor recreation programs and facilities provided additional benefits such as lowering levels of stress and anxiety or improved attitude and confidence in a group setting, particularly after COVID-19 emerged.

III. METHODS AND ANALYSIS

In this research study, forty students enrolled in a Rigid Body Dynamics course were surveyed to explore their academic and/or personal experiences within in the context of this hybrid environment. The study sought to examine the differences experienced by students who attended in person instruction and those who participated in remote instruction. When asked where they lived during the 2020-2021 academic year, only 7.7% of the student population remained at home outside the state of Texas, while 38.5% stayed on-campus, 38.5% returned but stayed off-campus, and 15.4% remained at home near campus.

An eight-question survey, which consisted of Likert Scale items as well as open-ended questions, was administered to the student participants. The authors utilized open coding to organize data into categories. According to Creswell (2007), open coding “involves taking data and segmenting them into categories of information” (p. 239-240). While all the data gathered from the survey provided useful information, the open coding process was repeated multiple times to slowly reduce the number of categories that became the major themes for each.

Participants were asked the following discussion questions:

Question 1: If you attended in-person instruction, what were the advantages and/or disadvantages?

Question 2: What are the advantages/disadvantages of watching lectures via Zoom?

Question 3: If you lived on-campus, what resources did you use to help you succeed during the semester? Check all that apply

Question 4: If you were fully remote during the 2020-2021 Academic Year, what were the advantages of being remote, and what were the main challenges?

Question 5: If you were fully remote, or watched lectures via Zoom, what factors need to be improved? Check all that apply

Question 6: If you attended in-person instruction at some point during the semester, were you able to talk to your instructor regarding class material? If YES, what were the advantages?

Question 7: How important was for you to talk (face-to-face) with your friends, classmates, or instructor during this academic year? Explain

Question 8: More than likely, face-to-face instruction will return for the next academic year. Is there something positive that you would like to keep moving forward (e.g., remote office hours, recorded lectures, remote meetings, etc.)? Explain.

Further, it is noted that descriptive statistics were employed for analysis and presentation of data results. Nonetheless, the study poses the following limitations: (a) small sample size; (b) self-developed survey instrument; (c) convenient sampling procedure

IV. RESULTS

Student Participant Responses

Summary of Findings

Summary of Feedback and Guiding Question One. The worldwide lockdown of businesses, industries, and federal agencies that were implemented and mandated to curb the spread of the virus generated a wide array of unique and fundamental challenges for organizations across the globe. One of those challenges included populations of students into overnight “work from home” or remote learners. Over time, some universities introduced policies to slowly return to in-person instruction, while offering students options to attend classes remotely. Such is the case with the present study and the ways in which students navigated from an on-campus experience to a completely virtual learning experience and back to in-person instruction. The first research question sought to elicit free responses from students asking them to describe their experiences with in-person classes: *If you attended in-person instruction, what were the advantages and/or disadvantages?*

According to participant responses, the major themes emerging from the aforementioned guiding questions included:

- Increased focus and level of engagement
- Interaction with instructors and peers

The authors explore each of these themes in the following sections:

Increased focus and engagement. The theme of increased level of focus and ability to concentrate was a prominent theme for students attending in-person instruction. One of the participants mentioned that it was much easier to stay engaged due to fewer distractions and temptations. Another student noted that it was “easier to remain engaged,” while another noted that it was “much easier to learn” the course material.

Interaction with instructors and peers. The theme of interaction with instructors and peers was also a common theme shared by students attending in-person instruction. Several students expressed that not only was it easier to stay engaged, but that by being in class led to “better interaction with professors.” One student shared the following: “I personally am less inclined to

participate in classes over Zoom, so being in person allowed me the opportunity to engage more with my professors and the course material in a way that worked better for me.” Although most students indicated positive benefits of being in class, a few indicated that it required more effort to attend in-person classes.

Summary of Feedback and Guiding Question Two. Question two sought to elicit free responses from students asking them to describe their experiences with remote learning and attending lectures via Zoom: *If you attended in-person instruction, what were the advantages and/or disadvantages? What are the advantages/disadvantages of watching lectures via Zoom?*

According to participant responses, the major themes emerging from the aforementioned guiding questions included:

- Flexibility and convenience to attend lectures and view recorded sessions
- Difficulty concentrating during lectures

The authors explore each of these themes in the following sections.

Flexibility and convenience. Students who attended class remotely noted that one advantage of this learning modality was the flexibility and convenience they had to learn course material. Several students mentioned that attending class remotely provided the opportunity to re-watch lectures, which helped to learn important concepts until grasping the material. Moreover, students expressed that attending class remotely also required much less effort to participate in lectures when compared to attending class on campus. One participant summed up the advantages of remote instruction: “It was more convenient to attend lectures via Zoom because it required less commute and you could literally roll out of bed and log on without having to get dressed, eat breakfast, etc. Also, the time between classes was more personally productive because rather than going from class to class I could eat, shower, etc. Also, re-watching lectures were very helpful if you missed class, needed more help on a topic, or wanted to review a topic.” By attending class remotely, students enjoyed the flexibility and convenience of reduced commute times and access to recorded content.

Difficulty concentrating during lectures. The same students that attended class remotely noted that one major disadvantage of this learning modality was the challenge to remain focused during online lectures. Students noted that it was much easier to get distracted and that it was less engaging than partaking in in-person instruction. A student shared that it was, “a lot easier to lose focus or get distracted during Zoom lectures, especially when muted and your camera is off, so I found myself struggling with material more often when I was taking more Zoom classes.” Additionally, students also encountered technological issues such as poor connectivity, audio issues, and difficulty to interact during lectures.

Summary of Feedback and Guiding Questions Three and Four. Questions three and four surveyed students living off campus to indicate the frequency with which they visited campus and the reasons for doing so. Exactly half of the students living off campus shared that they went to campus three times a week. A total of 12.5% of the students went to campus daily, while 25% visited campus once or week or never at all. As for the reasons for visiting campus, a total of 85.7%

of the participants went on campus to attend in-person class, while 71.4% indicated that visited campus to ‘get out of the routine of being at home,’ and to meet with friends, respectively.

Summary of Feedback and Guiding Question Five. Question five surveyed students living on campus about the resources which helped them to be successful with their coursework. The indicated three campus resources:

- 83.3% - Engineering design lab
- 83.3% - Socializing with friends
- 66.7% - Residential college study rooms

As evidenced by the data above, the common theme to all the responses is the social nature of each of the three elements listed above. In all three settings, students are immersed in an environment conducive to social and peer interaction, which is difficult to recreate for students learning remotely. In the engineering design lab, students can access machines (e.g., CNC, lathes, 3D-printers, etc.), computers, and tools needed to complete projects for engineering clubs, undergraduate research, or senior design classes.

Summary of Feedback and Guiding Question Six. Question six asked students attending class remotely to indicate what factors they believe need to be improved to enhance their learning experience. The participants were provided with a list of seven item response. The main three factors are listed below:

- 66.7% - Clarity of Whiteboard
- 66.7% - Internet connection
- 50.0% - More campus interaction with instructor and student colleagues

The factors listed above provide showcase some of the technical issues experienced by students learning remotely, which can assist instructors in making efforts to reduce inconveniences that constrain the effectiveness of remote instruction.

Summary of Feedback and Guiding Question Seven. Question seven asked students attending in-person class if they had the opportunities to engage with instructors regarding coursework. Most students indicated that they did have the opportunity to ask questions directly, which assisted in more efficient communication. One student noted that learning in-person “allowed me to engage more with course materials more than I would over Zoom and I was able to ask my professors questions in person.” Another student shared that it was easier to ask questions during in-person lectures instead of learning remotely because “the professor can actually see you.”

Summary of Feedback and Guiding Question Eight. Question eight asked students the importance of having direct, with both peers and instructors. All students agreed that having face-to-face interaction was extremely beneficial and vital to their academic learning. Aside from the academic advantages of having face-to-face interaction, students also cited social and mental health benefits. According to participant responses, the major themes emerging from the guiding questions included:

- Academic benefits
- Social and mental health benefits

Academic benefits. Students noted that their academic performance increased by attending in-person instruction. One student shared the following: “I did much better in in person classes, half due to the fact that it was easy to interact with students and professors.”

Social and mental health benefits. The social and mental health benefits of in-person learning was a prominent theme that emerged from the data. This factor was overwhelmingly the highest benefit as evidenced by student responses. Students revealed that remote instruction negatively affected their academic performance. One participant noted that: “Being completely remote in the spring of 2020 had an adverse effect on my mental state, which resulted in worsened performance.” A transfer student said that it was incredibly important to meet people. It kept me from feeling isolated and helped me make friends who I could study with. The opportunity to resume in-person was a welcomed change that prompted student to acknowledge the importance and value of social interaction. A student shared the following: “It is very important to have face-to-face interaction with people because it is the only way to actually develop relationships with people. I feel like I met a lot people this year virtually but never actually got to know them. Really only their names and maybe very few basic things.”

Summary of Feedback and Guiding Question Nine. Question nine asked the students the following: “*More than likely, face-to-face instruction will return for the next academic year. Is there something positive that you would like to keep moving forward (e.g., remote office hours, recorded lectures, remote meetings, etc.)? Explain.*” All students noted that they would appreciate ‘recorded lectures’ to continue during face-to-face instruction. One student cited the following: “Recorded/hybrid lectures and remote meetings were amazing. It meant that you weren't forced to travel during inclement weather and could reference material any time after the lecture. You weren't limited by your note taking ability.” Another participant shared that recorded lectures all them “to catch missed information makes note taking much less stressful, and actually helps focus on important points and concepts since you don’t need to write down every last bit just in case.”

V. CONCLUSION

In this research study, forty students enrolled in a Rigid Body Dynamics course were surveyed to explore their academic and/or personal experiences within in the context of this hybrid environment. The study sought to examine the differences experienced by students who attended in person instruction and those who participated in remote instruction. Eighty percent of the population attended in-person instruction and resided on or nearby campus, while twenty percent of the cohort remained fully online. The paper presents two student perspectives: 1) during the period in which courses were strictly delivered in a remote format, and 2) during the period in which students were afforded the opportunity to return to campus and partake in face-to-face instruction.

Study findings revealed that students engaged in-person instruction were able to focus and concentrate at higher levels than those learning remotely, as there were significantly less distractions and temptations to disengage with live and recorded lectures. Students learning remotely did indicate certain benefits such flexibility to watch recorded lectures and avoiding issues associated with comminuting to campus. Perhaps the most relevant and revealing finding

from the study centered on the social and academic impacts of having direct, face-to-face interaction with both peers and instructors. Students noted that this factor led to higher levels of engagement and academic success, while providing the necessary opportunities to build and sustain relationships with peers. Attending class physically helped curb the negative and damaging effects of isolation and served boost their overall socioemotional health. Future studies will continue to examine the long-term effects of learning in isolation, how students learned to cope during difficult circumstances, and how faculty members work to accommodate student learning needs.

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