A Survey to Understand Students' Preference between Synchronous and Face-To-Face Instructional Methods in an Undergraduate Engineering Class in the United States and an Overseas Campus

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Abstract

In response to COVID 19 Pandemic and to slow down its speed of public infection, all academic campuses in the United States and their branch campuses overseas had decided to shut down the face to face or in-person on-campus classes and replace them temporarily with virtually online methods using the available group communication software systems including Zoom, WebEx, SKYPE, etc. Although many articles reported the outcomes of some studies and assessments of the effectiveness of these methods on student learning ability and their responses to these alternative methods, no study has assessed students' learning abilities under these methods and based on their cultural backgrounds and locations.

This article intends to report the results of a comparative study of student learning in two undergraduate engineering courses in an institution in the United States and its international campus. The article reports the influence of cultural elements and student learning habits in these environments. It further reports on some modifications in the content and delivery methods that might be necessary to make a practical and positive impact on these learners.

Keywords
Synchronous; Face-to-face; Delivery Method; Student Learning; Learning Ability.

1. Introduction

The Western graduate education has often been an appealing goal to a large number of young Middle Eastern college-educated population (Retnanto et al. 2021; Retnanto et al. 2020). Historically, many scholars and those interested in

seeking post-baccalaureate degrees pursued graduate degrees in the United States or European academic institutions (Retnanto et al. 2020; Retnanto et al. 2020). In the early 2000s, many US and European institutions opened branch campuses offering a select number of highly demanded in their home institution degree programs locally. Several American and European higher education institutions deployed programs in the United Arab Emirates, Qatar, and other countries in the Middle East to provide opportunities for many young high school graduates to pursue academic degrees in engineering, medicine, business administration, computer science, and international relations (Retnanto et al. 2020; Qatar National 2015). One of the countries which have successfully implemented one of the most ambitious plans in establishing such programs is the State of Qatar. Qatar is a small peninsula in the Persian Gulf and shares the land border with the Kingdom of Saudi and maritime borders with Bahrain and Iran. Over 2.6 million currently reside in Qatar, of which about 80% are expatriates. Qatar's Vision 2030 focuses on the capacity development of its natives and has had made significant investments in training and educating its native population has been classified by the United Nations as a country of very high human development (Qatar National 2015; Toth 1993; Magee 2014; Commins 2021). Qatar's investment in human capital has been one of the primary reasons for six top-tier American institutions opening academic campuses in Qatar. Texas A&M University branch campus in Qatar (TAMUQ) is located in Education City and started its operations in September 2003. TAMUQ has been offering four ABET-accredited engineering degrees in Chemical, Electrical, Mechanical, and Petroleum since 2003, awarded undergraduate degrees to over 1,100 candidates as of May 2021.

2. Background

Adhering to the global pandemic guidelines and the safety of the residents, TAMUQ had adopted the fully online instructions using multi-media tools beginning March 2020. Although some students have already had experience with distance education and taking classes remotely from the main campus for many students, this has been a new phenomenon that needs to get adopted to and utilize the digital communication facilities available to them in Qatar (Retnanto et al. 2019; Retnanto et al. 2020; Retnanto et al. 2020). Unlike the United States, which will begin to utilize the new high-speed 5G communication system in January 2022, Qatar has been utilizing this mode of communication since 2019. However, aside from the availability of a high-speed network system throughout the State of Qatar, the primary question has been its effectiveness compared to the traditional face-to-face method of instruction that the majority of students have traditionally been used to them (Amani and Parsaei 2020).

3. The Comparative Study

The undertaken study had primarily been intended to conduct a comparative study of synchronous vs. face-to-face instructions of undergraduate engineering subjects on the United States and international campuses. To achieve the study's objectives, the authors developed a short questionnaire (screened and approved by the Office of Human Research Protection Program at Texas A&M University, College Station campus) asking students to convey their experiences in the classes taken prior (face to face) and during (online) the policy adopted by the institution due to COVID. The distributed questionnaire (see Appendix A) contained 20 questions which were divided into three categories, including basic demographics, advantages and disadvantages of taking classes remotely, and a comparison between face-to-face and remotely accessing the subject materials. One undergraduate course offered at Texas A&M University campus in College Station (ISEN 210 – Introduction to Industrial and Systems Engineering Design) and petroleum undergraduate students were selected for the study. ISEN 210 is offered in multiple sections in the fall and spring semesters. Two sections of the ISEN 210 participated in this study in the fall 2021 academic semester, and petroleum undergraduate students during the same academic semester.

Of 48 students who participated in the ISEN 210 (section 1), 17 were females, and 31 were males. The second section of the ISEN 210 (section 2) was made up of 13 females and 35 male students. The distribution of the gender in the petroleum undergraduate students was 21 females and 12 males. Enrollment in ISEN 210, section 1, included ten sophomores, 35 junior, and three seniors, whereas, in ISEN 210, section 2, 22 sophomores, 25 juniors, and one senior student were enrolled. Petroleum undergraduate students included 13 sophomores, 7 juniors, and 13 senior students. Over two-thirds of the students enrolled in ISEN 210 sections 1 and 2 identified their information technology (IT) skills at a moderate level; however, about 42 percent of the petroleum undergraduate students in the Qatar campus have chosen "high" for their IT skills (Figure 1). Around 50 percent of the students enrolled in ISEN 210 sections 1

and 2 have participated in any type of synchronous learning before the pandemic. In comparison, about 70 percent of the petroleum undergraduate students in the Qatar campus never participated in any type of remote learning.

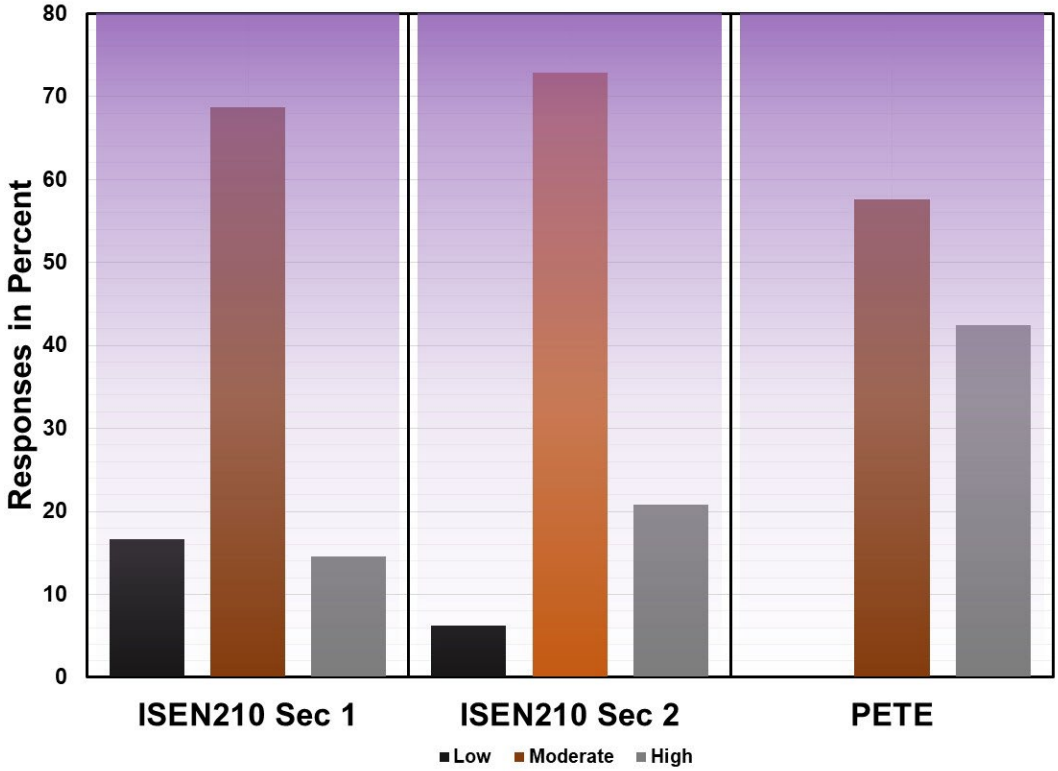

Figure 1 – Students Level Information Technology (IT) Skills

Figure 2 shows the advantages of participating in class remotely (synchronous learning). A large proportion of the students enrolled in the ISEN 210 sections 1 and 2 concluded that one of the most significant advantages of participating in the class remotely was the access to online materials (80% in the ISEN 210, section 1 and 70% in the ISEN 210 section 2). Another significant advantage of participating in the class remotely chosen by students enrolled in the ISEN 210, sections 1 and 2, was "the ability to stay home" (80% and 67%, respectively). Similar responses were provided by students enrolled in the petroleum undergraduate students on the Qatar campus. The Qatar campus students rated the "ability to stay home" at 85%, and the "access to online materials were selected by 76% as one of the significant advantages of synchronous learning. The class interactivity was rated as the lowest advantage of synchronous learning by all students (8% by ISEN 210 students in sections 1 and 2 and 24% by those enrolled in Qatar Campus).

Figure 3 presents the disadvantage of participating in class remotely (synchronous learning). About 83% of students selected the "reduced interaction with the teacher" as the most significant disadvantage of synchronous learning by students enrolled in the ISEN 210, sections 1 and 2 (83%), whereas 88% of petroleum undergraduate students selected the "technical problems as the primary disadvantages of the synchronous learning.

The logistical challenges of participating in class remotely can been in Figure 4. Quite/private space of study and reliable internet or remote connection are among the highest for the ISEN 210, sections 1 and 2 and the TAMUQ students. More than 60% of students highlighted the reliable internet or remote connection as the most logistical challenge by students enrolled in the ISEN 210, sections 1 and 2. Similar responses were provided by students enrolled in the petroleum engineering (50%).

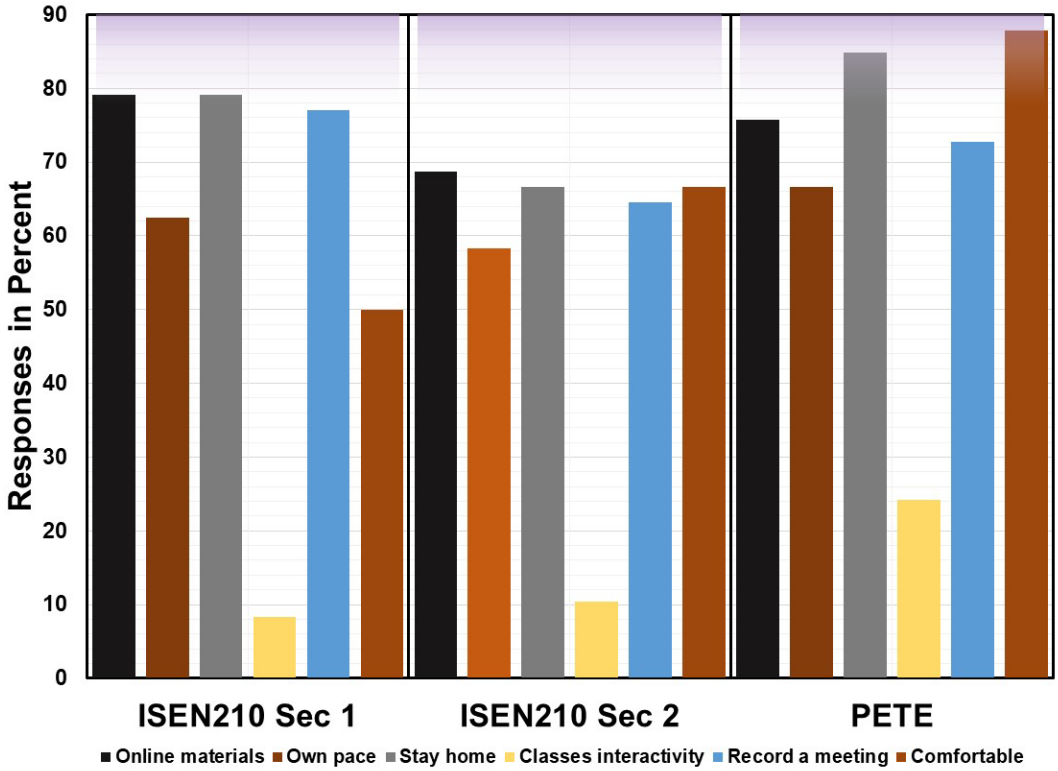

Figure 2 – Advantages of Participating in Class Remotely (synchronous learning)

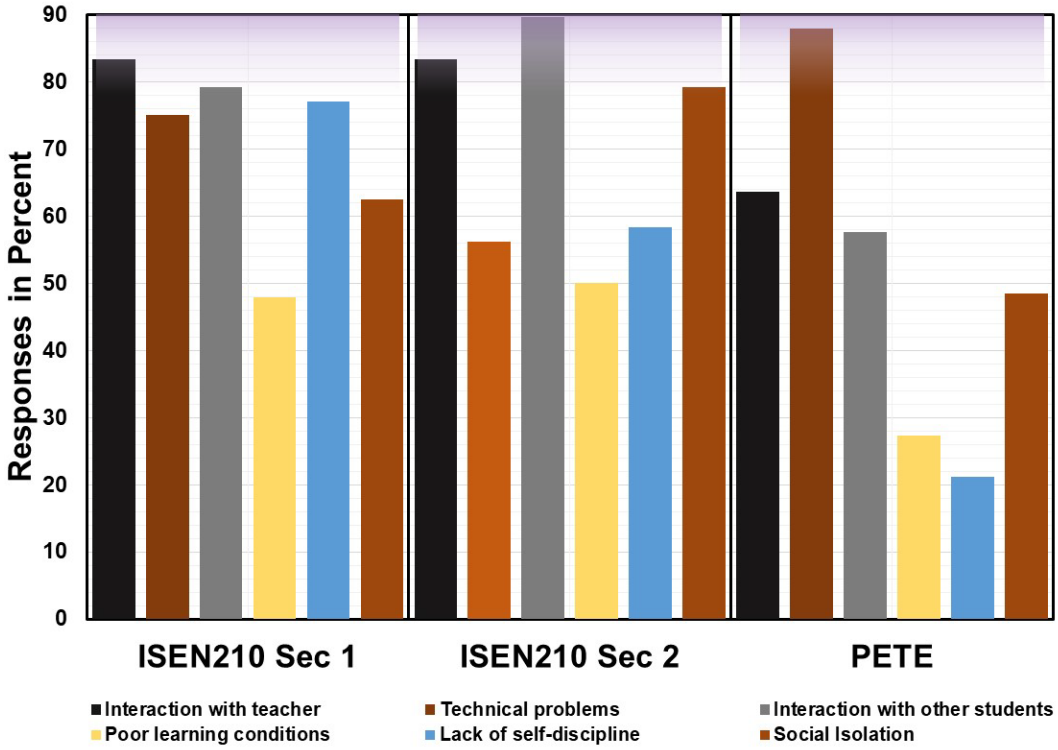

Figure 3 – Disadvantages of Participating in Class Remotely (synchronous learning)

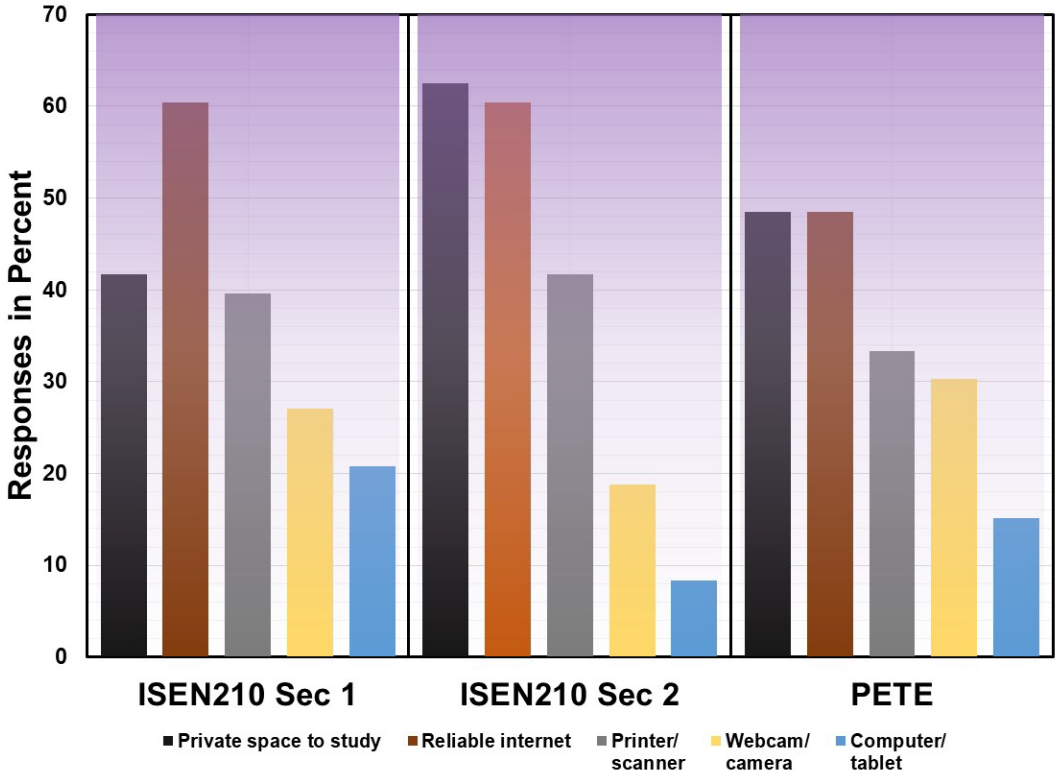

Figure 4 – Logistical Challenges of Participating in Class Remotely

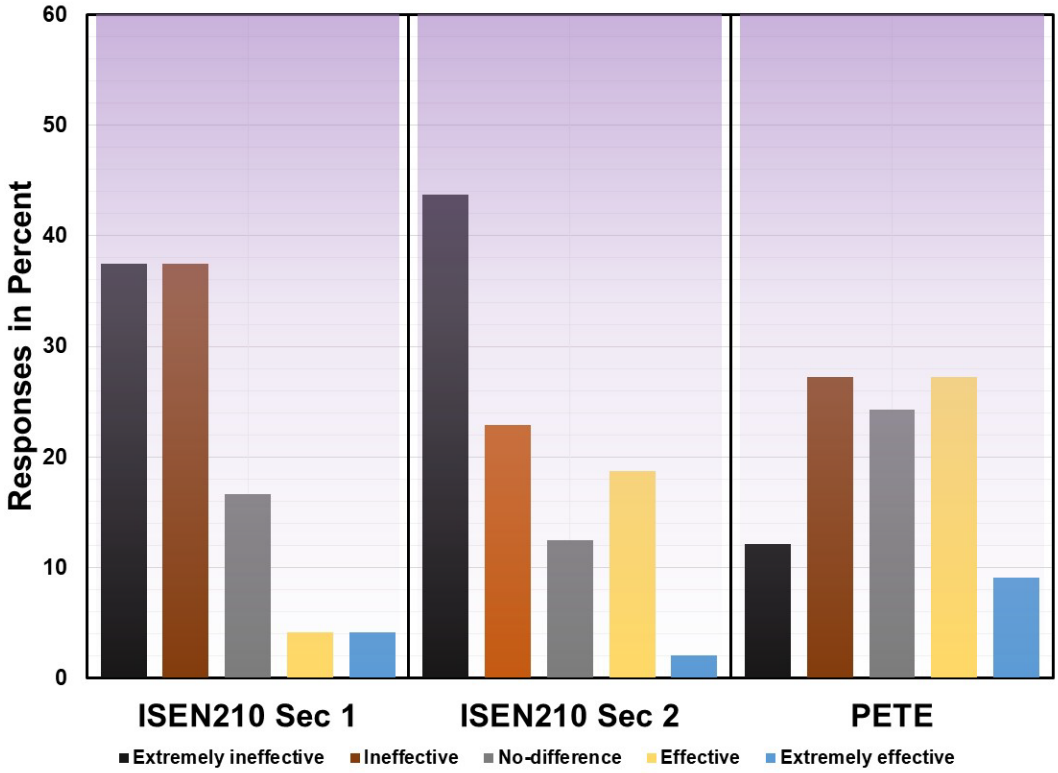

Figure 5 – Effectiveness of Participating in Class Remotely in Terms of Increasing Communications Skills

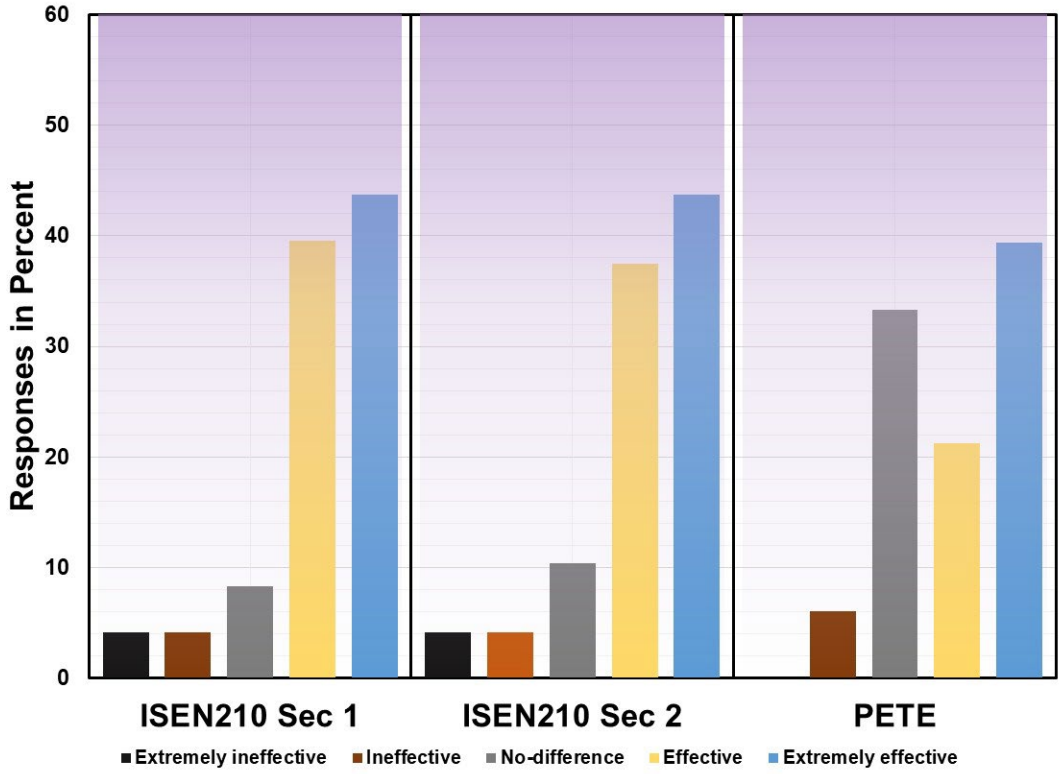

Figure 6 – Effectiveness of Traditional Face-to-Face Learning in Terms of Increasing Communications Skills

As a result of the survey, one of the significant observations was when students were asked regarding the effectiveness of participating in class remotely in terms of increasing communication skills (Figure 5). In the ISEN 210 sections 1 and 2, over 75% and 67%, respectively, felt that participating in class remotely in terms of increasing communication skills was ineffective or extremely ineffective. However, only 40% of petroleum engineering students in the Qatar campus came to the same conclusions. Furthermore, less than 20% (8% in section 1 and 20% in section 2) of students enrolled in the ISEN 210 found in class remote instruction (synchronous) effective or extremely effective, whereas 36% of petroleum undergraduate students in Qatar concluded the in-class (synchronous) remotely to be effective or extremely effective.

In comparison, students perceive the effectiveness of participating in class with the traditional face-to-face in terms of increasing communication skills (Figure 6). In the ISEN 210 sections 1 and 2, only 8% for both sections, felt that participating in class with the traditional face-to-face in terms of increasing communication skills was ineffective or extremely ineffective. A similar result, only 6% of petroleum engineering students in the Qatar campus came to the same conclusions. Furthermore, more than 80% (83% in section 1 and 81% in section 2) of students enrolled in the ISEN 210 found traditional face-to-face effective or extremely effective, whereas 60% of petroleum undergraduate students in Qatar concluded the traditional face-to-face to be effective or extremely effective.

4. Conclusion

As stated earlier, several similarities were identified among responses provided by students located on two campuses. A few significant differences observed included the information technology (IT) skills between students enrolled in ISEN 210 and petroleum undergraduate students in the Qatar campus. Another difference reported was Qatar's availability of a more reliable high-speed internet system (5G system has been in use since 2019). The survey results also separated the responses provided by male and female students; however, more information regarding these observations will be discussed in future presentations.

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Biography

Dr. Albertus Retnanto is a Professor of Petroleum Engineering at Texas A&M University at Qatar and has been in the Petroleum Engineering program since 2009. He received his Ph.D. degree in Petroleum Engineering from Texas A&M University. He teaches undergraduate courses in well testing, petroleum production systems, production engineering, petroleum technical presentation, natural gas engineering, and integrated asset development and makes significant curriculum enhancements to several courses. He held a Principal position with Schlumberger and has more than 18 years of experience worldwide in technical and management positions in well testing, field development, and production enhancement. Dr. Retnanto is an active Program Evaluator (PEV) with the Engineering Accreditation Commission (EAC) of ABET.

Dr. Hamid R. Parsaei is an internationally recognized leader in the field of engineering education, manufacturing automation, economic and financial decision making, leadership, and additive manufacturing with more than three decades of experience in academia. He is a fellow of the Institute of Industrial and Systems Engineers (IISE), American Society for Engineering Education (ASEE), Society of Manufacturing Engineers (SME), and Industrial Engineering and Operations Management Society International (IEOM). Dr. Parsaei is an effective educator and an innovative researcher who draws on considerable expertise to lead colleagues toward visionary goals and exceptional results. He served as the Chair of the Department of industrial Engineering at the University of Houston and Associate Dean of Academic Affairs at Texas A&M University at Qatar. He is a registered professional engineer in the State of Texas and an ABET Engineering Accreditation Commissioner and Program Evaluator.

Boback Parsaei is the Vice President of Operations with Integrated Technology Systems, Inc. an Engineering Consulting, in Houston, Texas. Mr. Parsaei received his undergraduate degree and M.Eng. in Civil and Environmental Engineering from Texas Tech University and Texas A&M University, respectively. He is currently pursuing Ph.D. degree in Civil and Environmental Engineering at Texas A&M University. He has extensive experience in the field of project management.

Appendix A: Survey

I. Basic demographics

1. What is your gender?
   - ☐ Male
   - ☐ Female

2. What engineering discipline are you pursuing? _____

3. What classification are you in?
   - ☐ Freshman
   - ☐ Sophomore
   - ☐ Junior
   - ☐ Senior

4. How would you describe your IT skills?
   - ☐ High
   - ☐ Moderate
   - ☐ Low

5. Have you ever participated in any type of synchronous learning before the pandemic?
   - ☐ Yes
   - ☐ No

II. Advantages and Disadvantages of participating in class remotely (synchronous learning)

6. What are the advantages of participating in class remotely (synchronous learning)? Pick all that you consider true.
   - ☐ Access to online materials
   - ☐ Learning on your own pace
   - ☐ Ability to stay at home
   - ☐ Classes interactivity
   - ☐ Ability to record a meeting
   - ☐ Comfortable surrounding

7. What are the disadvantages of participating in class remotely (synchronous learning)? Pick all that you consider true.
   - ☐ Reduced interaction with the teacher
   - ☐ Technical problems
   - ☐ Lack of interactions with other students
   - ☐ Poor learning conditions at home
   - ☐ Lack of self-discipline
   - ☐ Social isolation

8. Logistical challenges of participating in class remotely from your perspectives.
   - ☐ Quiet/private space to study
   - ☐ Reliable internet or remote connection
   - ☐ Printer/scanner
   - ☐ Webcam/camera
   - ☐ Computer/tablet

III Comparison between face-to-face learning and participating in class remotely (synchronous learning) in terms of ability to master learning objectives: knowledge, practical, and social competencies.

Student's activity during face-to-face learning and participate in class remotely (synchronous learning)

9. Using a five-point scale, rate the effectiveness of participating in class remotely (synchronous learning) in terms of increasing knowledge theoretically

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

10. Using a five-point scale, rate the effectiveness of participating in class remotely in terms of increasing practical/calculation skills

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

11. Using a five-point scale, rate the effectiveness of participating in class remotely in terms of increasing engineering laboratories skills

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

12. Using a five-point scale, rate the effectiveness of participating in class remotely in terms of increasing communication skills

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

13. Using a five-point scale, rate the effectiveness of traditional face-to-face learning in terms of increasing knowledge theoretically

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

14. Using a five-point scale, rate effectiveness of traditional face-to-face learning in terms of increasing practical/calculation skills

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

15. Using a five-point scale, rate the effectiveness of traditional face-to-face learning in terms of increasing engineering laboratories skills

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

16. Using a five-point scale, rate the effectiveness of traditional face-to-face learning in terms of increasing communication skills

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

17. Using a five-point scale, describe your class participation during in-class remotely (synchronous learning)

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

18. Using a five-point scale, describe your class participation during traditional face-to-face learning

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

19. Using a five-point scale, describe your academic performance during in class remotely (synchronous learning)

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective

20. Using a five-point scale, describe your academic performance during traditional face-to-face learning

- 1. Extremely ineffective
- 2. Ineffective
- 3. No-difference
- 4. Effective
- 5. Extremely effective