Lessons from the Pandemic – Improving on Student Engagement and Learning in Engineering Dynamics

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Abstract

Keeping students engaged and focused on learning has always been a challenge in Engineering Dynamics. Students come from all major engineering programs, and they range from the freshman to the senior level. As lectures went online during the pandemic, the challenges became more magnified. To meet these challenges, a modified version of MUSIC model of student motivation *(Jones, 2009*) was implemented with mixed results. In fall 2021, lectures were face-to-face. The model was implemented again in 4 sections with a total of 90 students. Based on the scores of student performances in assignments and comparison with previous semesters, there were improvements observed. However, within a given section, students at the junior (and above level) performed much better than students below junior level.

Background Information and the Pedagogical Issues

Background Information:

- GE 2230 (Engineering Mechanics -Dynamics) is a college wide course offered every semester.
- It is core requirement for Mechanical Engineering majors but is technical elective for students of all other majors.
- The students enrolled range from the sophomore to the senior level.

The Pedagogical Issues:

- Lack of engagement from students of non-mechanical engineering majors because the course is merely a technical elective.
- Different level of analytical maturity since the students range from the sophomore to the senior level. Besides, there are recent transfer students not adjusted to the rigors at a new institution.
- There are good number of students who support themselves financially by doing the odd job off-campus. Some of these students work for almost 20 hours a week. There are also non-traditional students who hold full time positions at their workplace. It is difficult for such students to devote enough quality time to their academics.

SoTL Problem to be Addressed

- The pedagogical issues got exacerbated in the synchronous lectures on ZOOM during the initial stages of the pandemic.
- An adapted version of the MUSIC model of student motivation (Jones, 2009) was used with limited success in the synchronous lectures on ZOOM.
- MUSIC stands for the abbreviation of empowerment, usefulness, success, interest, and caring.
- **The SoTL problem addressed in the WTFS program**: can lessons learned in implementation of the MUSIC model during the pandemic be used to improve on student engagement and learning in a face-to-face lecture setting?

Implementation of the MUSIC model -1

- Students learn a new concept by connecting with prior knowledge.
- Therefore, the course is designed to emphasize the conceptual aspects of the contents, while simultaneously highlighting the skills students would acquire irrespective of their major.
- Such an approach was a success in the synchronous lectures on ZOOM because students felt connected with the coursework irrespective of their major.
- In terms of MUSIC model , such an approach would correspond to the usefulness of the course material and interest in the coursework.

Implementation of the MUSIC model -2

- The lectures are interactive with conceptual questions being posed to the students in the middle of the lectures for extra credits.
- ***But instead of thinking aloud, the students are encouraged to think and email their responses***. This ensures all students (including the introverts) participate in the discussions and the learning process.
- Students get more than a week's time to return their assignments. This ensures the entire class is not hard pressed against time in their academics.
- In terms of MUSIC model, such an approach corresponds to the empowerment and caring of the students to ensure their success.
- Results are obtained by comparing the numbers on classroom attendance, participating in classroom discussion by emailing the responses, and the number of submissions of homework.

Results from Implementation of MUSIC model in Fall 2021 –Student Engagement

- When compared to the synchronous lectures on ZOOM, the results are inconclusive. This is because during the pandemic, around 20-30% of the enrolled students took up part-time jobs and they could not attend the synchronous lectures.
- Therefore, the numbers are compared with fall 2019, the semester just before the pandemic.
- **Attendance**: Pre-pandemic the attendance was around 70% on average. In fall 2021, attendance in lectures was around 90% on average. Late afternoon lectures usually see decreased attendance because of student athletes missing lectures or students working off-campus.
- **Student participation in discussion by emailing their thoughts**: Pre-pandemic less than 10% of the students would engage in discussion I the class. In Fall 2019, more than half the class would email their thoughts on any conceptual issues.
- **Number of students submitting their homework on schedule**: There was no appreciable change observed in this category.

Results from Implementation of MUSIC model in Fall 2021 –Student Learning

- Student learning was measured in terms of their performance in quizzes and exams. Homework scores were not included because students were allowed to workout their homework in groups.
- Overall, the class average in Fall 2021 was B- and in Fall 2019 was C.
- The group that improved the most were students who were at a junior level (or above).
- The group that still needs to work on their learning are students below the junior level. This could be because of the lack of analytical maturity.

References & Acknowledgements

Jones, B.D., *International Journal of Teaching and Learning in Higher Education*, 21(2), 2009, 272-285.

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