STUDENTS' PERCEPTION OF A FULLY ONLINE INTRODUCTORY BIOMECHANICS CLASS

ChengTu Hsieh

California State University, Chico, USA

The purpose of this study was to examine students' perception of a fully online introductory biomechanics class delivered in both synchronous and asynchronous format within the same class. Twenty-five students completed a survey regarding the pedagogical approaches utilised for synchronous and asynchronous meetings. Students reported that the pre-recorded videos and pre-work assignments helped the most for asynchronous learning. During synchronous class time, the most helpful strategy was the think-pair-share for questions to review the major concepts by answering several applied questions. Students had resistance to working in a small group (2-3 people) to complete assignments asynchronously. Recommendations for delivering biomechanics classes online should include sufficient time for the synchronous meetings to promote student-to-student contact.

KEYWORDS: virtual learning, pandemic, survey

INTRODUCTION: The spread of pandemics around the world has had a huge impact on both the education and research practices in the field of biomechanics. Traditional face-to-face (F2F) teaching and learning mode was abruptly moved to either online or hybrid (blended) mode since March of 2020. Even after one year, instructors and students are still adjusting to this transition to the new teaching and learning environment. Although the pandemic seems to be in better control, it is anticipated that many classes will remain in the virtual learning mode for 2021 and 2022 academic year based on the health department's policies. Thus, it would be good to evaluate the performance of the students in a virtual learning environment to determine what practices are effective.

While stay at home orders, quarantines, and social distancing precautions are essential public-health tool for curbing the spread of infectious disease, these measures may well have had the opposite effect on student learning. Students' perception of this sudden transition to virtual learning was also well documented (Serhan, 2020). In general, studies found that students have experienced and are continuing to experience widespread physical and mental distress as the pandemic continues. Students indicated their preference for the F2F mode and perceptions of online learning were negative (Knudson, 2020; Murphy et al., 2020). It is not surprising that the transition to online learning decreased student engagement, learning performance and retention (Chen et al., 2020; Guo, 2020; Shrhan, 2020). Researchers reported that increased burnout was among the top emotional concerns noted by students. All of these have translated into increased difficulty of learning content online (Charles et al., 2021; Murphy et al., 2020; Ramo et al., 2021; Wang et al., 2020).

Yet, a few studies reported significant learning gains using a blended modality (e. g., Knudson, 2020). To promote online learning, studies have suggested several different active learning strategies that do not require complicated technology (low-tech active learning strategies) such as problem-based learning, think-pair-share, etc. in both hybrid and F2F teaching environment (Knudson, 2020; Wallace & Knudson, 2020). For the course delivery, students preferred to have the lecture recorded with live synchronous discussion (Q & A) to engage in learning (Chen et al., 2020; Means & Neisler, 2020; Murphy et al., 2020). Darby (2021) suggested designing each class to be a mix of 25% synchronous and 75% asynchronous to prevent virtual teaching and learning burnout. It was also suggested to promote students' engagement by utilising small group assignments or discussions for both synchronous and asynchronous learning.

A 3-unit undergraduate introductory biomechanics class (150-minute lecture) was redesigned based on these suggestions for low-tech active learning strategies as a fully online class. The purpose of the current study was to review and examine the students' perception of the

strategies used in this class. Additionally, feedback from students may be used to adjust virtual instruction and further promote students' online science learning.

METHODS: A survey was administered in the middle of the semester to the 40 students who enrolled in an introductory biomechanics class. These students are from a mix of majors such as exercise physiology, movement studies, physical education, and health and wellness. Students were asked to rate each online pedagogical approach and provide suggestions if none of the options were helpful for their learning. The survey was delivered via Microsoft Office Form. The study was approved by the university IRB board.

During synchronous meetings, think-pair-share and problem-based learning were implemented to engage students in applying fundamental concepts. Before the synchronous meeting, students were required to read assigned textbook pages, watch pre-recorded videos, and answer pre-work assignments. All the videos and learning materials were posted weekly on the university learning management system, Blackboard Learn. A Likert scale rated 1-5 was used to evaluate the helpfulness of these approaches, with 1 being not helpful at all and 5 being very helpful. In addition, student's reflections on their learning behaviours were included in the survey (Table 1).

Table 1: Survey items for the helpfulness of the pedagogical approaches (1-9) and students' learning behaviour (10-13).

Learning Mode	Items
Synchronous	1. Review and highlight the readings assigned with practice questions (Think-pair-Share). 2. Do practice problems together with peers in the breakout room. 3. Work with peers to solve the in-class problems provided.
Asynchronous	4. The textbook reading assigned. 5. Watch pre-recorded videos. 6. The pre-work assignment based on the videos posted and reading assigned. 7. The YouTube videos assigned as other resources. 8. Do you think the in-class problem-based learning questions connected to your potential future career such as PE teacher, coaching, fitness/wellness, PT, or OT, etc. (1 as strongly disagree and 5 as strongly agree)? 9. When you think about the in-class problem-based learning, how relevant is it to the course content (1 Star as not relevant at all and 5 Stars as very relevant)?
Learning Behaviour	10. To reflect on your study of the course content, how many times have you read the textbook assigned? 11. To reflect on your study of the course content, how many times have you watched the videos posted? 12. In your other classes, when the professor uses the 100% online synchronous lecturing (e.g., 75 minutes going through slides), you are able to pay attention and follow through the class the whole time (1 as strongly disagree and 5 strongly agree). 13. While your camera and audio are off during a live online synchronous class, what are other activities that you are engaging (may select multiple of them)?

RESULTS: Sixty-three percent of the students (n = 25) completed the survey. Students' rating on the helpfulness of the pedagogical approaches are shown in Table 2. The topmost helpful three approaches are pre-recorded short videos, review questions during synchronous learning, and pre-work assignments to check their understanding of the concepts during asynchronous learning. Approximately 65% of the students reported that they watched the pre-recorded videos more than once before the weekly synchronous meeting. However, 57% of the students reported that they only read assigned textbook pages partially before the weekly synchronous meeting. Students mostly agree that the questions in problem-based learning connected to their future potential career and was relevant to the course content. Students also reported that they are able to pay attention (item 12) and follow through the class whole time to a full online live lecture class with an agreement of 3.13 ± 1.29 (1 being strongly disagree

and 5 being strongly agree).When students are attending a full online live lecture with their camera and audio off, they reported that they are mostly checking their social media (28%) and completing other tasks.

Table 2 Rating for helpfulness item 1-9.

Item	Rating	Item	Rating
1.	4.57 ± 0.73	6.	4.43 ± 0.78
2.	3.39 ± 1.37	7.	4.00 ± 1.00
3.	3.13 ± 1.30	8.	4.01 ± 0.86
4.	2.74 ± 1.14	9.	4.26 ± 0.69
5.	4.61 ± 0.58		

Item 10
- Did not read it at all
- Partially read it
- Read it all once
- Read it more than once

Item 11
- Did not watch them at all
- Watch a few of them
- Watch them all once
- Watch them more than once

Item 13
- Watching TV
- Chatting with peers online ab…
- Working (e.g., on the job)
- Checking social media
- Listening to music
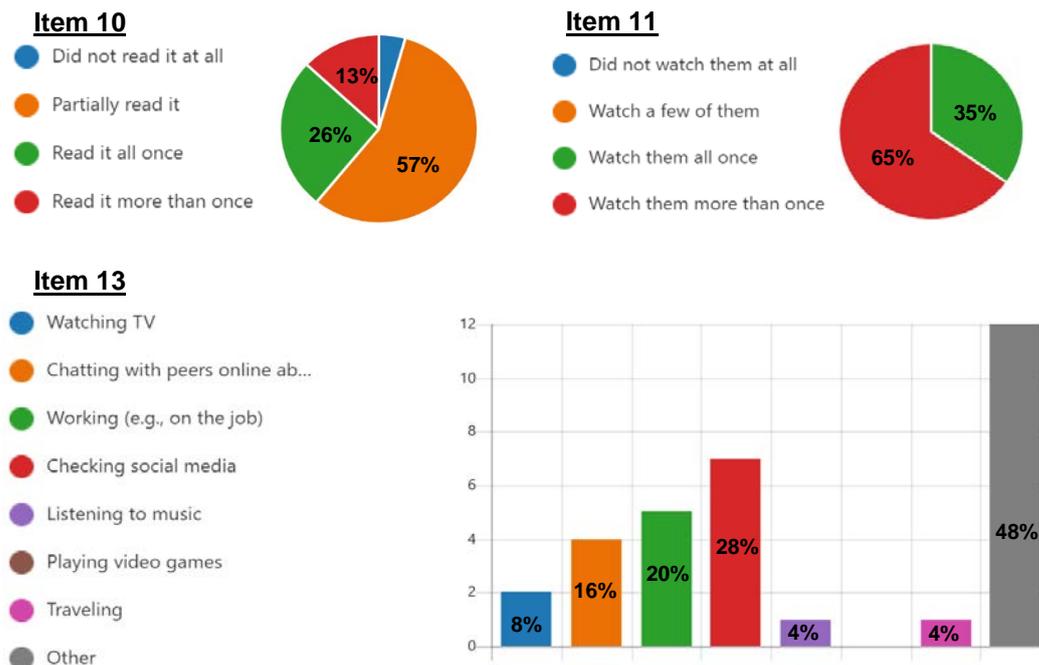- Playing video games
- Traveling
- Other

Figure 1: Distribution of students' learning behaviours for Items 10, 11, and 13 in %.

DISCUSSION: Nearly two-thirds of the class completed the survey and indicated the strategies that work well for the online introductory biomechanics class and indicated which areas needed more improvement. Students generally in favour of pre-recorded short videos and pre-work assignments to engage their learning. This is supported by the recent studies in related STEM areas that students preferred to have lecture recorded and be able to watch it again when needed (e.g., Chen et al., 2020; Darby, 2019 & 2021; Means, & Neisler, 2020). Item 13 shows that most students (48%) reported that they were distracted by other things during the synchronous meeting such as roommates and family members. This supports why there is a need to either record the online synchronous class or pre-record the class content to accommodate students' needs during the pandemic when the classroom, home, and work environments began blending together.

Knudson (2020) reported that there was a positive association between the student perception of the reading textbook before online video lesson and the perception of value of the video lesson for online portion. However, the current study found that most of the students only partially read the textbook pages assigned before the synchronous meeting and rated textbook reading as less helpful. This may be due to the pre-work assignments being heavily focused on the pre-recorded videos. These videos highlighted and summarised the textbook reading. Therefore, this arrangement may have encouraged students to watch the videos to answer the questions in the pre-work assignments. To encourage students to read the textbook pages assigned, a careful redesign of the pre-recorded video to reference the textbook and guided pre-work assignments along the textbook may be needed.

Both students' interest in subject matter and perception of the application toward their potential future career have a positive association with students' learning gain and class performance (Hsieh & Knudson, 2008; Hsieh et al., 2012; Pliner et al., 2020). In the current study, students shared that problem-based questions were relevant to course content and met their potential future careers. This finding correlated with the need to motivate and engage students using real-world scenarios in learning. While students' perception of working in a small group for problem-based learning was neutral in this study (Items 2 & 3), Knudson (2020) shared that 28% of the students may have resistance to group-based active learning. Students in the current study reported that the synchronous meeting time was too short, and it was difficult to find time to meet outside of class and work together. Additionally, while meeting outside of class, students reported the preference to work individually and independently. Therefore, it would be appropriate to lengthen the synchronous meeting time from 25% (40 minutes) to a longer period (60 minutes) while engaging students in problem-based active learning.

In summary, to move forward with a fully online introductory biomechanics class, it is suggested to pre-record videos and carefully integrate the textbook reading assignment into the pre-work assignments to promote students' engagement during asynchronous learning. During synchronous learning, preparing a series of review questions to check students understanding of the course content would be helpful. In addition, providing sufficient time for students to work on problem-based learning during a synchronous meeting can also be helpful.

CONCLUSION: While it is challenging to teach biomechanics fully online, students shared their perception of strategies to deliver the course content online. Pre-recorded videos for synchronous learning and think-pair-share to review the course content during synchronous meetings helped the most. The instructor should provide sufficient time during the synchronous meeting to promote student-to-student contact through problem-based learning. Problem-based learning should meet students' potential future careers to engage students' learning.

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