

Updates on a Work in Progress Assessing Student Perceptions of the Benefits of Continuing HyFlex Course Format Beyond the Covid-19 Pandemic

Dr. Nicole Becklinger, University of Southern Indiana

Nicole Becklinger is an assistant professor at the University of Southern Indiana. Her two primary areas of research are engineering educational methods and agricultural injury prevention. This research is part of an ongoing study investigating the potential student benefit of continuing to offer HyFlex course format as we move further from the Covid-19 pandemic.

UPDATES ON A WORK IN PROGRESS ASSESSING STUDENT PERCEPTIONS OF THE BENEFITS OF CONTINUING HYFLEX COURSE FORMAT BEYOND THE COVID-19 PANDEMIC

Nicole Becklinger

*Department of Engineering
University of Southern Indiana
Evansville, IN 47712
Email: [nlbeckling@usi.edu](mailto:nbeckling@usi.edu)*

ABSTRACT

The Covid-19 pandemic required instructors to rapidly adopt online, hybrid, and HyFlex course formats. This ongoing research study uses a survey to monitor student perceptions of academic and non-academic benefits to continuing to offer a HyFlex course format as we move further from the critical phase of the pandemic. Preliminary results from the Spring 2022 semester were presented at the American Society for Engineering Education 2023 national conference in Baltimore. This follow-up presents results from subsequent semesters through Fall 2023. Students from five courses taught using a HyFlex format across multiple semesters were eligible to participate in the study. This included multiple semesters of two introductory engineering courses, one sophomore/junior technical writing course, and two manufacturing technology courses. The HyFlex format used for these courses allowed students to choose on a day-to-day basis whether to attend class in person or synchronously online via Zoom. Video recordings of each class were uploaded to the course website for students who could not attend class synchronously and for all students to use as a study aid if they chose. Students who participated in these courses were invited to complete a short survey asking them how frequently they utilized in-person, Zoom, and video formats during the semester. Students were then asked to indicate their level of agreement with statements about whether the HyFlex format helped them meet course, other academic, health, work, and family responsibilities. Finally, students were asked several demographical questions, how many hours they worked per week during the semester, and whether they had caregiving responsibilities. This update for a work in progress presents new results from the Fall 2022 through Fall 2023 semesters and examines the full Spring 2022-Fall 2023 data set for any time-dependent trends. The utilization of Zoom and video formats has decreased over time. However, most students still attend class using a remote option at least once during the semester and perceptions of the benefits of HyFlex format are consistently favorable.

INTRODUCTION AND BACKGROUND

This article represents an update on an ongoing research study examining student perceptions of the benefits of continuing HyFlex course format beyond the COVID-19 Pandemic. Preliminary results from the Spring 2022 semester were presented at the American

Society for Engineering Education 2023 national conference in Baltimore¹. The current document covers the results of the same ongoing study through Fall 2023.

This study is the result of anecdotal observations made by the author during HyFlex instruction adopted during the 2020-2021 school year to accommodate absences due to illness and quarantine during COVID-19 pandemic. The HyFlex format adopted involved simultaneous in-person and synchronous online instruction via Zoom, with recordings of lectures uploaded after class. Students were instructed that synchronous attendance in either format was preferred and the videos were meant to accommodate students who could not make it to class. During this time, it was observed that the instructional practices adopted to accommodate COVID-19 absences were benefiting students in other ways. For instance, the same policies accommodated other illnesses, allowed student parents to stay home with children, allowed student workers to better accommodate work schedules, and in one case saved a commuting student four hours a week in commuting time. It was also noted that students were using video recordings as a study aid. This seemed particularly helpful for students who were new to coding in the freshman problem-solving class ENGR:107. Not only could students repeat examples as many times as needed, but they could also pause the videos to work through the examples themselves at their own pace. To support these observations with data and to monitor changes as we move further from the critical phase of the COVID-19 pandemic, the present study was developed in the Fall of 2021. Oversight of the study through the *institution name redacted* Internal Review Board and data collection began in Spring 2022.

A large percentage of students fall into groups who stand to benefit the most from HyFlex format. One of the largest groups who stands to benefit is student workers. According to the National Center for Education Statistics, in 2020, 40% of full-time undergraduate students are employed with 10% working 35 hours or more. For part time students, rates are even higher with 74% employed and 40% working over 35 hours per week². Another large group who stands to benefit, especially in areas that experience severe winter weather, is commuter students. Nationwide, only about 14% of students live in dorms, with over half of students commuting to campus from off-campus housing and approximately a quarter commuting from their parents' home³. Some students are parents themselves. The Institute for Women's Policy Research estimates that 22% of undergraduate students are parents, and of these approximately 70% are mothers. Approximately 62% of student mothers are single parents⁴. Students of color are more likely to be parents and approximately two out of five black women undergraduates are mothers⁵. An additional group that has benefited from the continuation of HyFlex format as extracurricular activities have resumed is student athletes, who often have to miss class for travel. Nationally, in 2022 over 520,000 students participated in National Collegiate Athletic Association sporting events⁶. Students with disabilities may also benefit from HyFlex formatting. According to Disabled Students UK, as many as 1 in 5 students has a disability and 84.5% of disabled students who responded to a 2021 survey indicated that they would benefit from a continuation online or remote learning options beyond the COVID-19 pandemic⁷. Some of the ways in which disabled students reported benefiting from remote or flexible learning included removing physical barriers and need to travel, having access to recordings for closed captioning and repetition, reduced

anxiety through being able to engage via text or anonymously, and having more ways of accessing the course materials⁷.

The body of research surrounding HyFlex course format is extensive and growing rapidly, with a 2022 literature review identifying over 1,400 articles on the topic⁸. While it is outside the scope of this article to review the entire body of literature in-depth, it is worthwhile to highlight a few recent examples related to STEM education.

Previous research has documented students having a generally positive perception of HyFlex format. For example in a pre-pandemic study over 86% of students in a Canadian Life Sciences undergraduate program found features of a HyFlex course platform helpful for accessing, engaging with, and learning course content, and the platform was especially helpful for those with a flexible learning need⁹. Over 75% of the 1486 students and 227 faculty members surveyed across multiple departments at the University of Sharjah strongly approved of a course format blending traditional in-person instruction with e-learning¹⁰. In a 2020 study, students at eight universities in Hong Kong provided detailed feedback on a HyFlex course titled Presentation Skills for Researcher Students. These students recognized that HyFlex format required students to take greater initiative to actively participate in class, but appreciated the ability to choose the format that was best on a given day based on their personal circumstances and whether they felt it was safe to attend in-person class on a particular week¹¹. In an engineering-specific study, students participated in a HyFlex design course where they interacted with clients from the local community. While student perceptions were not recorded, the study cited accommodating illnesses and quarantine, accommodating university campus closures, and allowing for student choice as benefits of using HyFlex¹². Another engineering-specific study that examined student ratings of a civil engineering program in 2020, 2021, and 2022. Student ratings of the program dropped to 3.8 out of 5 in the Spring of 2020 when there was a rapid shift to online only instruction, then rose to 4.1 for subsequent online-only and blended formats¹³.

Some of these studies have also weighed in on the potential drawbacks of HyFlex such as reduced interaction with other students or lower grades. The previously mentioned Canadian study did not find a difference in grades between students who attended primarily online or in-person, and that highly engaged students received better grades regardless of attendance mode⁹. A study comparing the performance of first-year mathematics students taking courses online vs in-person found that grades were significantly higher for female students from underrepresented groups taking a course online and were not significantly different for other groups¹⁴. Yet another study that took place in Singapore and Malaysia found no difference between scores for pre-pandemic in-person classes and online classes during the 2020-2021 academic year¹⁵.

METHODS

This research was conducted using an online survey, which was made available to students the last week of the semester in courses taught by the author using HyFlex format. This project is supervised by the University of Southern Indiana Institutional review board under a Type-1 Exempt from Review application, as no identifying information is collected by the survey

and the research presents minimal risk. The survey is administered through a Qualtrics link posted to the course Blackboard site. Students were made aware of the study via in-class announcements made several times the week before data collection. No incentives were offered to students for completing the survey. If students chose to click on the survey link, they were presented with a letter in the format prescribed by the University of Southern Indiana IRB containing study and IRB information. If students chose to continue, they were then presented with the survey questions. The survey takes approximately 5-10 minutes to complete, and students are able to exit the survey at any time without submitting their responses.

A summary of courses and students eligible to take the survey for each semester of the study can be seen in Table 1 below. The list consists of four courses taught multiple times between Spring 22 and Fall 23. The first course listed is Engineering Fundamentals. This is an introductory course that is required for all engineering majors. The course teaches the fundamentals of engineering problem solving using Microsoft Excel and MATLAB. The course is intended for first-year students, although in practice many of the students come in with enough transfer credit to have sophomore status their first year. In Fall, two sections of the course were taught by the author. The second course listed is Experimental Design and Technical Writing. As the course name implies, this course teaches students the basics of experimental design and how to write a variety of technical and professional documents. This class is required for all engineering students and is typically taken during their second year, although again in practice many of the second-year students have junior standing due to transfer credit. The remaining two courses, Manufacturing and Advanced Manufacturing, are a two-course sequence typically taken by manufacturing technology and industrial supervision students, but they are also engineering electives. Some students only take Manufacturing, and others take both courses in the sequence. Students are typically juniors or seniors.

Table 1: Summary of Courses By Semester with Number of Students

Course Number	Course Name	Semester	Number of Students
ENGR:107	Engineering Fundamentals	Spring 22	21
		Fall 22	38
		Fall 23	41
ENGR:291	Experimental Design and Technical Writing	Spring 22	16
		Spring 23	14
TECH:362	Manufacturing	Fall 22	15
		Fall 23	9
TechL367	Advanced Manufacturing	Spring 22	9
		Spring 23	13

The course survey administered to students can be broken down into three main sections. The first section asks students how frequently they used each of the three available class formats, in-person, Zoom, and video, and how frequently they did not attend class in any form. Possible responses for this section are: all cases, most classes, some classes, a few classes, and no classes. Part 2 of the survey contains 10 5-level Likert scale questions asking students to indicate their level of agreement or disagreement with statements related to the potential benefits and drawbacks of HyFlex course format. Questions one and two asked about potential benefits of Hy-Flex related to the course. Three through five asked whether Hy-Flex helped students meet other responsibilities not related to the class. Questions six and seven asked whether Hy-Flex helped students take care of their physical and mental health, and the last question asked if Hy-Flex should continue to be offered for the course. These statements can be seen in Table 2 below. Note that Table 2 is repeated from the previous ASEE publication on this study as the questions have not changed¹. This section also contained two free-response questions asking students to list the main advantages and disadvantages of HyFlex format. The third section asked for student demographic information including age, gender, hours spent working, and whether the student had caregiver duties.

Table 2: Summary of Likert Scale Questions

Item Number	Statement
1	Flexible course formatting improved my ability to keep up with course materials
2	Flexible course format improved my ability to understand the course materials
3	Flexible course format allowed me to better meet work commitments
4	Flexible course format allowed me to better meet family commitments
5	Flexible course format allowed me to better meet other academic or university commitments
6	Flexible course format allowed me to better take care of my physical health
7	Flexible course format allowed me to better take care of my mental health
8	Flexible course format made it more difficult for me to work with other students
9	Flexible course format made it more difficult for me to understand the course materials
10	Flexible course format should continue to be offered for this class

RESULTS

A summary of the counts of student responses by semester can be seen in Table 3 below. Note that the results include summaries of data collected in Spring 22, which was already examined in detail in the previous publication related to this study [citation placeholder to avoid revealing author identity]. However, it is important to include a copy of this data to examine time-dependent changes. Overall response rates were low. This is particularly true of the Spring 23 semester where a delay in IRB renewal for the project shortened the number of times eligible

students were made aware of the survey leading up to data collection. Due to the small sample size, data from the Fall 22 and Spring 23 semesters will be assessed together.

Table 3: Summary of response rates by semester

Semester	Students Eligible	Started Survey	Completed surveys	Response Rate
Spring 22	46	19	12	26%
Fall 22	53	3	3	6%
Spring 23	27	2	1	4%
Fall 23	50	8	6	12%
Total	176	32	22	13%

A summary of respondent demographics can be seen in Table 4. Of the 22 participants, 16 were male, 4 were female, and 2 did not indicate their gender. The average age of participants was 22 years, however this number skews upward a bit due to two older students. Most students were between 18 and 21 years old. Approximately 55% of respondents reported working during the semester, with 14% working more than 30 hours a week. A total of 4 students reported being a caregiver.

Table 4: Demographics Summary

Gender	Spring 22	Fall 22/ Spring 23	Fall 23	Cumulative
Male	11(92%)	2(50%)	3(50%)	16(73%)
Female	1(8%)	1(25%)	2(33%)	4(18%)
No Response	0(0%)	1(25%)	1(17%)	2(9%)
Age				
Min	19	18	18	18
Avg	22	19	23	22
Max	42	20	37	42
Hours worked per week				
0	4(33%)	2(50%)	1(17%)	7(32%)
1-10	4(33%)	0(0%)	2(33%)	6(27%)
11-20	0(0%)	1(25%)	0(0%)	1(5%)
21-30	1(8%)	1(25%)	0(0%)	2(9%)
30+	2(17%)	0(0%)	1(17%)	3(14%)
Unspecified	1(8%)	0(0%)	2(33%)	3(14%)
Caregiver				
yes	2(17%)	0(0%)	2(33%)	4(18%)
no	10(83%)	3(75%)	4(67%)	17(77%)
unspecified	0(0%)	1(25%)	0(0%)	1(5%)

The utilization of each course format can be seen in Tables 5 through 7 below. Table 5 shows the utilization of in-person classes. All students surveyed attended in-person class at least once, and for approximately 73% of students, in-person instruction was their primary means of class attendance. Approximately 18% of students used Zoom as a primary means of class attendance, and over two thirds of students used Zoom at least once during the semester. Table 7 shows the utilization of lecture recordings. As students were instructed to use the videos as a study aid or to make up absence, it is not surprising that no students used video as their primary means of class attendance. However, more than half of students utilized video recordings of lectures at least once during the semester. With regards to time-based trends, the utilization of Zoom and video formats decreased over time. In the Fall 22 semester, two thirds of students did not use Zoom and two thirds did not use video. However, the third of students who used each of these formats were different students, so it is also accurate to say that two thirds of students used at least one of the alternate formats during the Fall 23 semester.

Table 5: Utilization of In-Person Class By Semester

	Spring 22	Fall 22/Spring 23	Fall 23	Cumulative
All Classes	1(8.3%)	0 (0%)	3(50%)	4 (18%)
Most Classes	7(58.3%)	2(50%)	3(50%)	12 (55%)
Some Classes	1(8.3%)	1(25%)	0 (0%)	2(9%)
A Few Classes	3 (25%)	1(25%)	0 (0%)	4 (18%)
No Classes	0 (0%)	0 (0%)	0 (0%)	0(0%)
Any Utilization of this Format	12(100%)	4(100%)	6(100%)	22(100%)

Table 6: Utilization of Zoom by Semester

	Spring 22	Fall 22/Spring 23	Fall 23	Cumulative
All Classes	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Most Classes	2 (16.7%)	2(50%)	0 (0%)	4 (18%)
Some Classes	3 (25%)	0 (0%)	0 (0%)	3(14%)
A Few Classes	4 (33.3%)	1(25%)	2(33%)	7(32%)
No Classes	3 (25%)	1(25%)	4(67%)	8(36%)
Any Utilization of this Format	9(75%)	3(75%)	2(33%)	22(100%)

Table 7: Utilization of Video by Semester

	Spring 22	Fall 22/Spring 23	Fall 23	Cumulative
All Classes	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Most Classes	1 (8.3%)	0 (0%)	0 (0%)	1(5%)
Some Classes	2 (16.7%)	0 (0%)	0 (0%)	2(9%)
A Few Classes	6 (50%)	2(50%)	2(33%)	10(45%)
No Classes	3 (25%)	2(50%)	4(67)	9(41%)
Any Utilization of this format	9(75%)	2(50%)	2(33%)	22(100%)

Results for the Likert Scale questions can be seen in Table 8 and Table 9. Table 8 contains the percentage of students strongly or somewhat agree with each statement and Table 9 contains the percentage of students who strongly or somewhat disagree. In the name of saving space, questions where no student indicated disagreement are omitted from Table 9. Overall, student perceptions of the benefits of offering HyFlex course format were positive across all semesters, with three quarters of students or more agreeing with statements about the academic and non-academic benefits of continuing flexible course work. The lone disagreement to these statements was one student in the Spring 23 semester who disagreed with the statement “Flexible course format improved my ability to understand course materials”. For the two statements involving potential drawbacks of offering HyFlex format, with roughly a third of students agreeing with these statements and roughly half disagreeing.

Table 8: Count and Percentage of Students Strongly or Somewhat Agreeing with Likert Scale Questions

Statement	Spring 22	Fall 22 /Spring 23	Fall 23	Cumulative
Flexible course formatting improved my ability to keep up with course materials	12(100%)	4(100%)	5(83%)	21(95%)
Flexible course format improved my ability to understand the course materials	10 (83%)	2(50%)	6(100%)	18(82%)
Flexible course format allowed me to better meet work commitments	9 (75%)	4(100%)	6(100%)	19(86%)
Flexible course format allowed me to better meet family commitments	9(75%)	3(75%)	5(83%)	17(77%)
Flexible course format allowed me to better meet other academic or university commitments	11(92%)	4(100%)	5(83%)	20(91%)
Flexible course format allowed me to better take care of my physical health	10 (83%)	4(100%)	6(100%)	20(91%)
Flexible course format allowed me to better take care of my mental health	11 (92%)	4(100%)	6(100%)	21(95%)
Flexible course format made it more difficult for me to work with other students	6(50%)	0(0%)	2(33%)	8(36%)
Flexible course format made it more difficult for me to understand the course materials	3(25%)	0(0%)	2(33%)	5(23%)
Flexible course format should continue to be offered for this class	11(92%)	4(100%)	6(100%)	21(95%)

Table 9: Count and Percentage of Students Strongly or Somewhat Disagreeing with Likert Scale Questions

Statement	Spring 22	Fall 22 /Spring 23	Fall 23	Cumulative
Flexible course format improved my ability to understand the course materials	0(0%)	1(25%)	0(0%)	1(5%)
Flexible course format made it more difficult for me to work with other students	3(25%)	4(100%)	3(50%)	10(45%)
Flexible course format made it more difficult for me to understand the course materials	7(58%)	4(100%)	4(67%)	15(68%)

Student understanding of the potential benefits and drawbacks of HyFlex course format can be seen in Table 10, which summarizes the results of the free-response questions asking students to list advantages and disadvantages of HyFlex. No percentages are included in this table because many students indicated multiple items in their responses. The key benefits students identified were helping accommodate schedule conflicts, more easily making up for an

absence, and using videos as a study aid. Most students either said there was no disadvantage or left the disadvantages question blank. Those who identified disadvantages most commonly indicated that it could be more difficult to ask questions or could encourage students to be lazy/not attend class.

Table 10: Summary of Advantages and Disadvantages Listed in Free Response Section

Advantages	Spring 22	Fall 22/ Spring 23	Fall 23	Cumulative
Better able to accommodate scheduling conflicts with other commitments	5	0	3	8
Better able to catch up in event of absence	4	0	1	5
Videos used as a study aid	3	1	1	5
Reduced stress or anxiety for the class	2	0	0	2
Zoom option	1	1	0	2
Able to complete more assignments on time	1	0	0	1
Able to get work done for other classes	1	0	0	1
Would have skipped some classes entirely if alternate formats not available	1	0	0	1
General flexibility of the course	1	0	0	1
Helps commuter students	0	1	0	1
This item left blank	0	1	0	1
Disadvantages				
None/no problems/etc	5	0	1	6
More difficult to participate or ask questions	4	0	0	4
Less incentive for attendance/students may become lazy	1	2	1	4
Harder to get to know classmates	0	1	2	3
Flexible format worked well for this class, but might not for others	3	0	0	3
Get a little less from virtual vs in-person participation	1	0	1	2
Tendency to rush through content	1	0	0	1
Harder to keep up with assignments	1	0	0	1
Potential for technology failure	1	0	0	1
This item left blank	1	1	1	3

DISCUSSION

In general, student perceptions of HyFlex course format have been consistently positive. Students consistently report both academic and non-academic benefits to continuing HyFlex format. There was particularly strong agreement with the statements related to Hy-Flex allowing students to better keep up with coursework and better take care of their mental health, with only one student for each category not agreeing or strongly agreeing. All but one student also agreed that Hy-Flex should continue to be offered, and no students disagreed with that statement.

While this study did not explicitly ask respondents for their disability status, almost all students agreed that they were better able to manage their physical and mental health due to Hy-Flex and no students disagreed with those statements. This may indicate that while accommodating disability is essential, all students may benefit from Hy-Flex features such as multiformat access, the ability to repeat materials, and closed captioning. Over two thirds of the students surveyed work during the semester, with several respondents working full time or near-full time. Four of the students surveyed reported being caretakers, and three of the respondents were non-traditional students returning to school in their 30s and 40s. While one major limitation of this study is that the dataset is still too small to compare the responses of members of these groups to more traditional undergraduate students, it is an indication that some of the groups who face additional challenges are being represented in the survey and have a positive opinion of Hy-Flex.

Utilization of Zoom and video formats has decreased as we have moved further from the pandemic, however all but 2 students used an alternative format at least once during the semester. This data corresponds well with anecdotal observations made by the PI. As time goes on, fewer students are relying heavily on Zoom and video formats, but they are still being used when students must miss class. There are also still cases where lack of alternate attendance options would cause students to miss class entirely. This is especially true for student athletes and student workers. In the manufacturing technology program especially, more students are attending class remotely from their workplace compared to engineering courses. In short, it seems that more students prefer in-person attendance and are using the other formats as a supplement in case of absence but for the smaller group of students with significant scheduling conflicts or other barriers to in-person attendance, maintaining HyFlex format is critical.

Additional insights can be gained from examining the answers to the free-response questions. In these results we can see that dealing with schedule conflicts and absences is one of the main ways in which HyFlex can benefit students. Students also continue to see benefit to using recorded lectures as a study aid. As previously mentioned, this practice seems to be particularly helpful for students who are new to programming in Engineering Fundamentals.

Another question that arises looking at student answers to the free-response questions is whether the continuation of HyFlex format affects student engagement. Several respondents cited the possibility of students becoming lazy and not attending class as a potential disadvantage of using Hy-Flex. There are two ways to think of this. By offering HyFlex format,

are we losing students who would have performed well and been engaged in the class if in-person attendance was mandatory, or are students who would have stopped attending in-person class entirely able to continue because of the other options? While the data in this study is not suited to answer this question directly, anecdotally there are a few students that fall into both of those categories. When considering this question, we also have to weigh the potential detrimental effects with the benefits to students for whom flexible attendance options are essential.

One of the major limitations of this research is the small pool of participants. While the low response rate is not unexpected for a survey that is offered without incentives, that fact combined with the small class sizes at [institution name redacted] it means that the sample sizes for this study have remained small. Since students are self-selecting, it is also possible that the students completing the survey are those who are most impacted by HyFlex. The small sample size also hinders the ability to perform more rigorous statistical analysis of the data. It is also worth mentioning that only a limited range of courses taught by the same instructor were eligible to take the survey. Again, this is partially due to the small size of [institution name redacted]'s engineering program and the trend towards classes either being fully in-person or fully online. Because the survey is anonymous and does not ask students about class performance, it is also not possible to compare survey responses with student performance during class. Additional data collection is planned to continue tracking trends over time and to allow for more in-depth analysis.

CONCLUSION

While the utilization of synchronous Zoom and video options has declined as we move further from the pandemic, most students are still utilizing alternate attendance options at least once during the semester. For some students with substantial barriers to in-person attendance, the continuance of HyFlex format is critical. Further research is needed to continue to monitor time-based trends and to allow for more in-depth analysis.

WORKS CITED

- [1] N. Becklinger, "Preliminary Results from a Work in Progress Assessing Student Perceptions of the Benefits of Continuing HyFlex Course Format Beyond the COVID-19 Pandemic," in *2023 ASEE Annual Conference & Exposition papers*, Baltimore, 2023.
- [2] National Center for Education Statistics, "College Student Employment," May 2022. [Online]. Available: [https://nces.ed.gov/programs/coe/indicator/ssa/college-student-employment#:~:text=The%20percentage%20of%20full%2Dtime,in%202015%20\(43%20percent\)..](https://nces.ed.gov/programs/coe/indicator/ssa/college-student-employment#:~:text=The%20percentage%20of%20full%2Dtime,in%202015%20(43%20percent)..) [Accessed 9 September 2022].
- [3] National Center for Educational Statistics, "National Postsecondary Student Aid Study," 2016. [Online]. Available: <https://nces.ed.gov/datalab/codebooks/by-subject/121-national-postsecondary-student-aid-study-2016-undergraduates>. [Accessed 11 February 2022].
- [4] United States Government Accountability Office, "More Information Could Help Student Parents Access Additional Federal Student Aid," August 2019. [Online]. Available: <https://www.gao.gov/assets/gao-19-522.pdf>. [Accessed 11 February 2022].
- [5] L. R. Cruse, T. Holtzman, B. Gault, D. Croom and P. Polk, "Parents In College By the Numbers," 11 April 2019. [Online]. Available: https://iwpr.org/wp-content/uploads/2020/08/C481_Parents-in-College-By-the-Numbers-Aspen-Ascend-and-IWPR.pdf. [Accessed 11 February 2022].
- [6] NCAA, "NCAA student-athletes surpass 520,000, set new record," NCAA, 5 December 2022. [Online]. Available: <https://www.ncaa.org/news/2022/12/5/media-center-ncaa-student-athletes-surpass-520-000-set-new-record.aspx>. [Accessed 21 January 2024].
- [7] Disabled Students UK, "Going Back is Not a Choice: Acessability Lessons for Higher Education," Disabled Students UK, 2022. [Online]. Available: <https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fdisabledstudents.co.uk%2Fwp-content%2Fuploads%2F2022%2F03%2FGoing-Back-is-Not-a-Choice-Large-Print-editable.docx&wdOrigin=BROWSELINK>. [Accessed 21 January 2024].
- [8] N. B. Eduljee, R. Chakravarty, K. Croteau and L. Murphy, "Understanding Research Trends in HyFlex (hybrid flexible) Instruction," *International Journal of Instruction*, vol. 15, no. 4, pp. 1308-1470, 2022.
- [9] Z. Adeel, S. M. Mladjenovic, S. Sara J, P. Sahi, A. Dhand, S. Williams-Habibi, K. Brown and K. Moisse, "Student Engagement Tracks with Success In-Person and Online in a Hybrid-Flexible Course," *The Canadian Journal for the Scholarship of Teaching and Learning*, vol. 14, no. 2, 2023.

- [10] E. Mushtaha, S. A. Dabous, I. Alsyof, A. Ahmed and N. R. Abdraboh, "The challenges and opportunities of online learning and teaching at engineering and theoretical colleges during the pandemic," *Ain Shams Engineering Journal*, vol. 13, 2022.
- [11] L. Kohnke and B. L. Moorehouse, "Adopting HyFlex in higher education in response to COVID-19:," *Open learning: The Journal of Open, Distance, and E-Learning*, vol. 36, no. 3, pp. 231-244, 2021.
- [12] C. M. Wigal, "Teaching the Design Process in a HyFlex Environment," *Journal of Higher Education Theory and Practice* , vol. 21, no. 10, pp. 226-235, 2021.
- [13] S. G. Farrag, M. F. Abushammala and S. Kuckian, "Transitioning from Pandemic to Endemic Pedagogy: Redesigning Teaching and," *SHS Web of Conferences*, vol. 156, pp. 1-5, 2023.
- [14] J. E. Clinkenbeard and M. V. Bonsangue, "Academic Outcomes and Experiences of Freshman Students in Mathematics Courses During the COVID-19 Pandemic," *Learning Assistance Review*, vol. 27, no. 1, pp. 15-54, 2022.
- [15] Y. Y. Koh and Y. L. Chua, "Implementation of Online Learning for Engineering Courses: A," in *Annual SEAAIR Conference Proceedings* , online, 2021.