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Student Engagement Across Course Teaching Modalities

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Student Engagement Across Course Teaching Modalities

Abstract
In this study, we compare student engagement across delivery modes (asynchronous online, synchronous online, and a mix of in-person, hyflex, and hybrid or blended teaching) at a small liberal arts undergraduate institution where faculty could choose their teaching mode. Student engagement involves students connecting with course material, the instructor, and fellow students. Student engagement is important due to its relationship with learning, retention, and student satisfaction. Using an online student survey and information on teaching modality, we examine how this mode affected students' behavioural and affective engagement. Using both quantitative and qualitative analyses, investigate the following questions: how did the teaching mode affect student engagement and what can faculty do to encourage engagement? We find that student behaviours and beliefs reported in our survey indicate that the lack of in-person instruction did not significantly negatively affect student engagement at the university under study. We find that one of our measures of student engagement was higher in courses offered asynchronously online. Given this result, we use qualitative data analysis to untangle the factors that might support higher levels of engagement.

Dans cette étude, nous comparons l'engagement des étudiants et des étudiantes en fonction des modes d'enseignement (asynchrone en ligne, synchrone en ligne et un mélange d'enseignement en personne, hyflex et hybride ou mixte) dans un petit établissement d'arts libéraux de premier cycle où le corps enseignant pouvait choisir son mode d'enseignement. L'engagement des étudiants et des étudiantes implique que ceux-ci se connectent au matériel de cours, à l'instructeur ou à l'instructrice et aux autres étudiants et étudiantes. L'engagement des étudiants et des étudiantes est important en raison de sa relation avec l'apprentissage, la rétention et la satisfaction des étudiants et des étudiantes. À l'aide d'une enquête en ligne auprès des étudiants et des étudiantes ainsi que d'informations sur les modalités d'enseignement, nous examinons l'impact de ces modalités sur l'engagement comportemental et affectif des étudiants et des étudiantes. À l'aide d'analyses quantitatives et qualitatives, nous étudions les questions suivantes : comment le mode d'enseignement a-t-il eu une influence sur l'engagement des étudiants et des étudiantes et que peuvent faire les enseignants et les enseignantes pour encourager l'engagement? Nous constatons que les comportements et les croyances des étudiants et des étudiantes rapportés dans notre enquête indiquent que l'absence d'enseignement en personne n'a pas eu d'effet négatif significatif sur l'engagement des étudiants et des étudiantes dans l'université étudiée. Nous avons constaté que l'une de nos mesures de l'engagement des étudiants et des étudiantes était plus élevée dans les cours proposés en ligne de manière asynchrone. Compte tenu de ce résultat, nous utilisons une analyse qualitative des données pour démêler les facteurs susceptibles de favoriser des niveaux d'engagement plus élevés.

Keywords
engagement, online learning, asynchronous learning, hybrid learning, blended learning, hyflex learning; engagement, apprentissage en ligne, apprentissage asynchrone, apprentissage hybride, apprentissage mixte, apprentissage hyflex

Cover Page Footnote
We would like to thank all the faculty and students who participated in this study. Special thanks also go out to our tireless research assistants. This work would never have been undertaken without the encouragement of fellow Scholarship of Teaching and Learning (SoTL) researchers in our region who provided guidance and input on the SoTL process in the early stages of this project. We also thank everyone who participated and provided feedback during presentations of early versions of this research at the STLHE 2022 Conference and beyond.

Why and How did we Study Student Engagement?

In February 2020, the COVID-19 pandemic forced educators and students into unprecedented educational scenarios forcing post-secondary institutions to transition away from in-person instruction (Brown, 2021). This meant that during the 2020/21 academic year instructors had to introduce a variety of approaches to reach students at a distance and many students were compelled to embrace online learning (Mishra et al., 2020). We exploit this exogenous transition to online learning to determine if teaching mode affects student engagement. This fills a significant gap in existing literature as no previous studies have been able to compare engagement across teaching modalities without having to deal with the issue that students who take classes online have self-selected into this teaching mode and are not comparable to the general population of students. We hypothesize that students are less engaged when they do not have in-person interactions with their instructors or fellow students because students will have to be more self-motivated and are likely to feel isolated; for students who take asynchronous online classes, contact with faculty and fellow students is usually through online forums and recorded lectures, which eliminates live communication and is likely to make relationships more distant.

This study was conducted at a small liberal arts undergraduate institution in an area where COVID infection rates during the 2020/21 academic year were low and where facilities could accommodate social distancing so classes could be offered in-person or online. This institution has relatively small class sizes (the largest class in our study had 103 students), a high entering average (the entering average for students is over 86%), and mainly young students (just over 7% of students are 25 years of age or older). Instructors in our study chose the teaching approach that they felt was most appropriate for their courses, students, and pedagogy. We refer to this choice as teaching mode or modality and examine how this choice affects student engagement. Students had little choice over teaching mode since they either took the course the way it was offered or declined to register.

After obtaining ethics approval from our Research Ethics Board for our research, we used a semi-structured approach to interview nine faculty volunteers representing 10 classes. At the end of the 2020 fall semester, we asked faculty participants to distribute an email invitation to their students to participate in an anonymous online survey. This survey asked students about their behaviours, attitudes, and impressions of class atmosphere during the semester. We combine this quantitative data with data from faculty members on teaching approaches to compare reported engagement across teaching modalities. This quantitative analysis is then supplemented with qualitative analysis of open-ended survey questions about what features of classes encourage and discourage student engagement. We also do some preliminary qualitative analysis on faculty interviews to get instructors' perspectives on engagement and teaching during a pandemic.

Students in our sample did not have the option to choose their course's teaching modality; if they wanted to take a specific course, students had to accept the mode selected by their instructor. This means our data reduces the problem of self-selection across the different teaching modes; this situation is often referred to as a natural experiment and the data collected in our study is best described as quasi-experimental.[1] This allows us to get better insight into how the average

[1] Ideally, to test the effect of teaching mode on engagement, we would like experimental data but randomly varying teaching mode is probably not possible as students would not be receiving effectively equivalent instruction. This means that the only feasible solution is to exploit circumstances like COVID to obtain quasi-experimental data. For hyflex courses, this assertion is somewhat modified by the fact that students could opt to attend virtually although they were encouraged to attend in-person if it was feasible.

student's engagement is affected by teaching mode and offers insights into how students who are not typical online learners respond to the online learning environment.[2]

In the next section, we discuss what student engagement is, why it is important, and most importantly how we quantify it. We then ask what factors affect student engagement. Details about our data collection process and summary statistics about our sample are contained in the subsequent section. We then look at how our measures of engagement vary across teaching modes and what multivariate analysis reveals about the effect of teaching mode, students' demographics, students' environment, and learner autonomy on engagement. In the following section, we then delve deeper into what students and faculty report encouraged and discouraged engagement. Finally, we conclude by summarizing our findings and discussing what makes our work unique.

What is Student Engagement, Why is it Important, and How Do We Use Our Survey to Measure it?

To study engagement, we need a clear definition. We know that student engagement is composed of physical and mental energy, requires active involvement, and is a multi-dimensional construct consisting of behavioral, cognitive, and affective components (Appleton et al., 2006; Astin, 1984, 1994; Feldman, 1994; Fredricks et al., 2004; Handelsman et al., 2005; Heilporn et al., 2021; Lee, 2014). In our analysis, we examined both behavioural and affective engagement; we measured behavioural engagement using a broad range of classroom behaviours, including involvement in learning and participation in classroom activities (Fredricks et al., 2004) and affective engagement is measured using questions about how students feel about their classes (Finn, 1993; Lee, 2014; Willms, 2003).

To understand why engagement is important, we turned to existing empirical studies. Research shows that: there is a positive relationship between engagement and academic performance at the post-secondary level (Ayala & Manzano, 2018; Buechele, 2020; Buelow et al., 2018; Handelsman et al., 2005; Kuh et al., 2008); engaged students are more connected to their learning (Dennen et al., 2007; Dixson, 2015; Kehrwald, 2008; Robinson & Hullinger, 2008; Shea et al., 2006; Swan et al., 2000); and that engagement is essential for student satisfaction and course completion (Chen et al., 2008; Conner, 2011; Hattie & Anderman, 2012; Hew, 2016; Kuh, 2003; Robinson & Hullinger, 2008). Handelsman et al. (2005) claim that "engaged students are good learners" (p. 184) and according to Buelow, Barr & Rich (2018) engagement is "one of the most significant factors in academic success" (p. 314).

Our Survey of Student Engagement (SSE) collected data on engagement at a course level. We measured engagement on multiple dynamically interrelated dimensions by using a series of questions to capture both behavioural and affective engagement. Our SSE questionnaire borrows from four existing surveys: the Student Course Engagement Questionnaire (SCEQ); the Student Engagement Instrument (SEI); the Classroom Survey of Student Engagement (CLASSE); and the Online Student Engagement Scale (OSE) (Appleton et al., 2006; Dixson, 2010, 2015; Handelsman

[2] Improvements in technology and the desire to reach a more diverse set of students have meant that the use of online learning at post-secondary institutions has grown (Johnson et al., 2019). According to Dixson (2015), chief academic officers report that online learning is important for the future. Since these trends are likely to persist, analysis like that in our study is important for predicting the effect of a move to online education.

et al., 2005; Ouimet & Smallwood, 2005).[3] In addition to a series of Likert-scale questions about behaviours, feelings, and attitudes, we also posed two open-ended questions about what features of their class encouraged or discouraged engagement. To supplement student class-level engagement data, we collected information on learner autonomy as well as demographic and environmental information about the students. A list of all the survey variables collected is available upon request.

The first component of engagement that we studied was behavioural engagement; this is a measurement of the extent to which students actively engage by thinking, talking, and interacting with the course content, other students, and the instructor. We divided behavioural engagement into two factors: participation engagement and skills engagement (Dixson, 2010; Handelsman et al., 2005). The final component of engagement was affective engagement which attempts to measure students' emotional states during learning (Handelsman et al., 2005; Skinner et al., 1990). To obtain aggregate measures, we sum the scores across the questions used for the three different measures of engagement.

Our participation measure of engagement explores how often students display specific behaviours such as: asking questions; contributing to class discussion; working with other students; tutoring or helping other students; communicating with the instructor outside of class time; discussing ideas from the course with fellow students; discussing ideas from the course with others outside of the class; and coming to class prepared. Students could rank how often they participated using a scale from "never" to "very often."

The skills engagement factor was measured by asking respondents about "how much like me" certain behaviours were. These included: studying on a regular basis; putting forth effort; staying current on readings; taking good notes of readings; taking good notes of lectures, PowerPoints, videos, etc.; reviewing class notes between class meetings or while offline; being organized; listening/reading carefully; getting to know other students in the class; and applying course material to their lives. Students indicated that these behaviours were "not at all like me" to "very like me."

Affective engagement is a more complicated concept to measure so we chose to focus on how students felt about the classroom environment. This involved asking questions of students about how strongly they agreed or disagreed with the following characterizations: I was comfortable talking with the instructor; I enjoyed collaborating with my classmates on assignments and projects; it was easy to follow the class lectures; I connected to the material in the class; the instructions for your class were clear; the course content was connected to your prior knowledge or societal problems.

What Affects Student Engagement?

Understanding what enables engagement is an ongoing area of research. Studies suggest that teaching pedagogy and institutional structures are relevant (Bowden et al., 2021; Kahu, 2018; Porter, 2006; Umbach & Wawrzynski, 2005) and that student motivation and effort play a key role (Schuetz, 2008; Zepke et al., 2010). Student engagement at school has also been found to be influenced by family demographic and socio-economic status as well as the environment in which

[3] These questionnaires were designed for specific settings so we adapted them to function for the multiplicity of teaching modalities. Appleton et al. (2006), Dixson (2010, 2015), Handelsman et al. (2005) and Ouimet & Smallwood (2005) show that their measures of engagement have adequate construct validity.

the student learns (Duan et al., 2018; Finn, 1989; Lee, 2014; Marks, 2000; Muir et al., 2019; Steele, 1997; Thill et al., 2016; Zepke et al., 2010).

For our study, we focused on instructors' teaching modality but clearly student characteristics affect engagement as well. We controlled for these confounding factors by incorporating information about the students' characteristics (gender identity, employment status, living alone, have a continuing scholarship, racialization, first-generation student, English as an additional language, and age) and their environment (access to food and housing insecurity) in our multivariate analysis. Our multivariate analysis also includes two measures of learner autonomy: independence of learning and study habits. These measures of learner autonomy are based on a series of questions developed by Macaskill & Taylor (2010). The level of independence of learning is calculated by asking respondents how well the following behaviours, thoughts, and feelings describe them: enjoy new experiences, enjoy a challenge, stick with it, and take responsibility. The Study Habits measure was calculated by asking students if they were "good with deadlines" and whether they "do not make excuses." These measures are higher the more autonomous a learner is (Macaskill & Taylor, 2010). We include these measures because they provide a proxy for student motivation and effort.

Although we focus on teaching modality, we cannot reduce all the instructional factors that affect engagement into this one variable. While it is difficult to quantify educators' behaviours, we undertake a qualitative data analysis of open-ended SSE questions and faculty interviews to examine what teaching strategies support engagement.

Who Participated in Our Study?

What Faculty Participated and What Teaching Modalities Did They Use?

During the 2020 fall semester at a small liberal arts undergraduate university, we purposively recruited instructors from a variety of disciplines to obtain representation from the university's three faculties and across teaching modalities. Our sample relied on volunteers, many of whom were known for their interest in the Scholarship of Teaching and Learning (SoTL). Since we relied on volunteers, our sample may not be representative but because participants were known to be interested in SoTL, it is likely that our sample consists of more engaged instructors with an interest in teaching pedagogy who can provide unique insights into how to engage students. In total, we interviewed nine faculty members from the Faculty of Science, the Faculty of Social Sciences and Business, and the Faculty of Arts. The nine faculty who were interviewed represent ten different courses. For confidentiality reasons, all but one of the classes included in the study had enrollments exceeding 40 at the time this study began. The instructors in our sample used a variety of different teaching modes ranging from in-person to asynchronous online.

To obtain accurate measures of how teaching proceeded during the 2020 fall semester, we interviewed our faculty participants twice: once at the beginning of the semester and once at the end of the semester. This allowed us to capture any modifications and revisions that were made during the semester especially those that resulted from the progress of the pandemic. For this study, we were interested in how the teaching mode implemented by faculty affected student engagement. We exploit the variability in teaching modalities to test whether teaching mode affected student engagement.

To say there were as many teaching approaches as there are instructors in this study is probably not too much of an exaggeration. For empirical analysis, we classified teaching modes

into five categories (see Table 1). Only one class in our study was offered in hybrid format and, for the purposes of this study, students were randomly assigned students to meet in-person or virtually with only 3 students requesting a change in their teaching mode. For the three classes that were offered as hyflex, students had the option of attending in-person or online; to account for this, we augmented data provided through faculty interviews with student reports from our SSE to classify a student as attending mainly online or in-person.[4] The resulting seven teaching modalities and their definitions are listed in Table 1.

Table 1
Classifying Teaching Modes

Mode Classification	Definition	Number of Classes per Mode
Hyflex In-person	In-person and simultaneous online instruction which the student mostly attended in-person	3
Hyflex Online	In-person and simultaneous online instruction which the student mostly attended online	3
Synchronous Online	Students attended online at a specified time (over MS Teams or Zoom)	2
Asynchronous Online	Students chose when to connect with online content	2
Asynchronous with Voluntary Synchronous	Asynchronous content but students could also choose to join synchronous online components	2
Hybrid In-person	Asynchronous content with in-person meetings	1
Hybrid Online	Asynchronous content with synchronous online meetings	1

Which Students Participated in Our Survey?

To reach diverse students, we purposely selected faculty participants who taught in different faculties and used different teaching modalities. Many of our faculty participants had a demonstrated interest in SoTL which should strengthen our results since that these faculty have demonstrated a strong dedication to their teaching pedagogy. Since most of our instructors did not have experience with online instruction before COVID and given the balance of faculty across disciplines, we are confident that we have not intentionally biased our sample in favour or against any particular teaching modality.

To obtain data on how engaged students were, we created our Survey of Student Engagement (SSE) and asked our faculty participants to send an email invitation (on our behalf) to their students inviting them to complete our survey online at the end of the 2020 fall semester. The survey was available for two weeks with an initial survey invitation being sent out on Dec. 2, 2020, and a reminder sent on Dec. 9, 2020. The survey questionnaire asked students to reflect on

[4] For the hyflex courses, students had the option to attend virtually or in-person although the latter was generally encouraged by faculty.

the semester and tell us about their classroom behaviours, feelings and thoughts, and general impressions of the class atmosphere. We also collected additional information on the student characteristics including demographic variables, environmental information, and information related to student autonomy. The survey instrument consisted of 27 questions and a list of the survey variables and associated questions is available upon request. To satisfy research ethics requirements, all survey responses were anonymous and for confidentiality reasons, we only present our data in an aggregated form that does not allow the identification of respondents. Our Research Ethics Board also requested that we only survey classes of over 40 students to protect confidentiality. This meant that many of the courses under study were 1000-level or first-year courses. The results derived from this sample remain strong as engagement in first-year college has been shown as important to student success (Kuh et al., 2008; Kahu & Nelson, 2018; Wyatt, 2011; Bowden, Tickle & Naumann, 2021). It is also important to note that survey responses were voluntary, raising the concern of self-selection. As our results below show, the respondents are representative of the student population under consideration and there is also no reason to think that teaching modality affects willingness to complete the survey.

The total enrollment from the ten courses involved in this study was 543. Of these 543 students, 145 responded (at least in part) to our survey, for a response rate of 26.7%. When the sample is restricted to the number of respondents that can be included in the analysis of our engagement measures, the response rate was 21.9% for participation engagement, 21.2% for skills engagement, and 12.9% for affective engagement. This sample size means that when we disaggregate the data by teaching modality there is limited data so we use small-sample analysis and limit our multivariate analysis to a comparison of asynchronous online courses vs. all other teaching modes.

The faculty participants were purposively selected so that we included instructors from all three faculties at the university under examination and so that we have sufficient variability in teaching modality. Despite the non-random nature of the courses involved in this study, the resulting set of student survey respondents is quite diverse and comparable in demographics to the university population.

Table 2 compares the demographics of our respondents with those of the institution's student population. The distribution of demographic characteristics of our respondents closely matches that of the population on most variables with the following exceptions: survey respondents were slightly more likely to choose the "Other/Not Available/Refuse" for their age category and our sample contains a relatively high proportion of respondents that are in the 18-19 age category possibly because half of the classes involved in this study were classified as introductory 1000-level.

Table 2

Demographics of our Respondents vs. the University Population

Variable	Values	Survey Respondents	Population
Year (Population includes graduate students in "Other")	First	35.7%	34.2%
	Second	27.0%	25.2%
	Third	21.7%	20.5%
	Fourth or above	13.0%	18.3%
	Other/Not Available/Refuse	2.6%	1.9%
Age	Under 18	0.9%	1.1%
	18-19	54.8%	41.1%
	20-21	31.3%	38.0%
	22-24	7.0%	14.0%
	25+	6.1%	6.3%
Gender ("Other" not available for Population)	Male	36.5%	41.6%
	Female	57.4%	57.6%
	Other/Not Available/Refuse	6.1%	0.8%
Program (Population includes graduate students in Other)	BA	43.5%	40.6%
	BComm	23.5%	13.2%
	BSc	27.0%	37.7%
	Other/Not Available/Refuse	6.1%	8.6%
FirstGen (Population is "Yes" or "N/A")	Yes	17.4%	17.1%
	No	78.3%	-
	Other/Not Available/Refuse	4.4%	82.9%
Minority (Population only identified "Indigenous")	Indigenous	0.9%	2.1%
	Racialized Minority	9.7%	-
	Other	2.7%	-
	None of the above	81.4%	-
	Not Available/Refuse	5.3%	97.9%
Where Live (Population only identified "In residence" or "N/A")	In residence	35.7%	35.8%
	Off-campus in Sackville	46.1%	
	Off-campus within commuting distance	8.7%	
	Off-campus, too far to travel	7.0%	
	Other/Not Available/Refuse	2.6%	64.2%

Table 3 shows the additional demographic and environmental data collected. It indicates that most of our respondents were not employed, did not live alone, and had English as their first language. Surprisingly, 57% of our sample claimed to have a continuing scholarship. Another surprising statistic is that almost one-quarter of our respondents indicated that they sometimes or always felt that they did not have physical and economic access to sufficient, safe, and nutritious food to meet dietary needs and food preferences for an active and healthy life. The rate of housing insecurity is much lower with only just over 6% of respondents indicating that their housing situation was not at all stable or secure or somewhat stable or secure. As with food insecurity,

housing insecurity is likely to have a significant effect on cognitive ability and student engagement therefore even a few students being housing insecure is concerning.

Table 3
Other Demographics of Our Respondents

Variable	Value	Survey Respondents
Employed	Not Employed	63.5%
	Employed FT or PT	36.5%
Live Alone	Do not live alone	93.0%
	Live alone	7.0%
English as First Language	Yes	86.1%
	No	13.9%
Scholarship	Yes	57.4%
	No	40.9%
Food Access	Had access to food	75.7%
	Did not have access to food (always/sometimes)	24.4%
Housing Insecure	How housing insecure	93.9%
	Housing insecure (not/somewhat stable	6.1%

What Does Our Survey of Student Engagement (SSE) Tell Us About Engagement?

The SSE asked students to reflect on their experiences in a specified class and collected data on students' thoughts, feelings, and behaviours related to this class.[5] Given the survey data, we can calculate a participation measure of engagement, a skills measure of engagement, and an affective measure of engagement by summing the 5-point responses from questions associated with each measure of engagement. Low scores indicate low levels of engagement and high scores indicate high levels of engagement. Unfortunately, these measures can only be calculated for respondents who answered all the questions associated with each measure of engagement. For participation and skills engagement this amounts to 119 and 115 respondents respectively but for the affective engagement measure we only had 70 respondents. When respondents are categorized by teaching modality the sample sizes become small so, for the multivariate analysis, we only compare asynchronous online instruction with all other modalities grouped.

The participation measure of engagement runs from 8 to 40. We observed an average level of participation of 19.35 with a standard deviation of 5.38, a median of 19, a minimum of 9, and a maximum of 36. On a zero-to-one scale, the average for participation engagement was 0.35, and the standard deviation was 0.17. This data demonstrates that average and median participation engagement were lower than the midpoint of our scale with some students not participating much while others engaged quite actively. The Cronbach's alpha for this participation factor of engagement was 0.6957, indicating that inter-item consistency was fairly high.

[5] We do not use data from learning management software for our analysis because this only focuses on online engagement and not all the types of engagement that we consider in this study. Although that data would be informative, it provides a limited perspective on student engagement with materials online. It was determined that collecting and collating this data was prohibitively time consuming for something that would not provide the type of insights we were seeking.

Our measure of skills engagement could range from 10 to 50. We observed a minimum value of 16, a maximum value of 50, a mean of 34.36, a standard deviation of 7.51, and a median of 35. On a zero-to-one scale, the average for skills engagement was 0.61 and the standard deviation was 0.19. This indicates significant variability in the levels of skills engagement and a relatively high average and median. The Cronbach's alpha for the engagement factor skills was 0.8496 meaning that inter-item consistency was high.

Our measure of affective engagement could range from 6 to 30 with 6 indicating strong disagreement or negative feelings and 30 indicating strong agreement or positive feelings. The resulting average in our sample of 70 was 21.03, the standard deviation was 4.79, the minimum was 10, the maximum was 28, and the median was 23. On a zero-to-one scale, the average skills engagement was 0.63 with a standard deviation of 0.2. This suggests that affective engagement was relatively high. The Cronbach's alpha for affective engagement was 0.7662 indicating that inter-item consistency was fairly high.

A first step in examining whether teaching mode affects student engagement is to compare average engagement levels across the different teaching modalities. As you can see from Table 4: Engagement, the average engagement levels appear to vary little across teaching modes. Using small sample *t*-tests, we find that only one is statistically distinguishable from the others: average skills engagement is higher for students whose classes were delivered asynchronously online. These results are surprising as we hypothesized that students who did not interact with their instructors or classmates in-person would have lower engagement. This result was also startling because faculty only had four months and limited support to pivot to online instruction during COVID. Clearly, there is more at play here that needs to be examined but it seems that asynchronous courses can be designed in a way to encourage engagement even when some faculty and students report preferring in-person instruction in interviews and open-ended survey questions respectively.[6]

Table 4
Engagement Scores

	Participation			Skills			Affective		
Teaching Mode	Mean	StdDev.	*n*	Mean	StdDev.	*n*	Mean	StdDev.	*n*
Hyflex Online	19.5	6.1	32	34.9	7.6	30	19.5	4.8	20
Hyflex In-person	17.3	4.6	4	36.7	2.1	3	19.0	NA	1
Synchronous	24.0	4.6	7	34.9	5.1	7	25.6	2.3	5
Asynchronous	20.7	5.1	20	39.1	6.9	20	23.5	4.4	10
Hybrid Online	18.1	3.2	14	31.4	6.4	14	19.6	4.4	11
Hybrid In-person	21.7	7.3	6	37.3	7.2	6	19.2	4.8	5
Asynch with voluntary synch	17.8	4.9	34	31.2	7.7	33	22.1	4.6	17

Regression analysis that incorporates other student characteristics allows us to determine whether observed differences in average engagement are due to teaching mode or student characteristics. We limit this analysis to skills engagement and only consider a comparison of asynchronous online instruction with all other modes of instruction. For simplicity, we created a

[6] A qualitative analysis of reported experience of online instruction is beyond the scope of this paper. It should be noted that our current research will be addressing this in a future paper.

variety of binary variables, listed in Table 5, that take on a value of one if the criterion is true, and zero when false. Using the indicator of whether the course was offered asynchronously together with dummy variables that capture student characteristics and the measures of independent learning and study habits as control variables, we ran a regression on skills engagement. Table 5: Regression Results for Skills Engagement shows the results. The first thing to note in Table 5 is that, even after controlling for student characteristics, courses that were taught asynchronously online still report higher average skills engagement. This strongly suggests that the mode of course delivery has a significant effect on engagement even though the direction of this effect is opposite to what we hypothesized. This is particularly startling since most instructors had no experience teaching online and limited time and support was provided for the emergency pivot to online instruction during COVID.

Table 5

Regression Results for Skills Engagement

Variable	Estimate	Std. Err.	*t* value	*p*-value	
Intercept	12.03	4.09	2.940	0.004	**
Course was offered Asynchronously online	5.55	1.57	3.55	0.001	**
Respondent was female	0.64	1.19	0.534	0.594	
Respondent was employed full time	1.83	3.79	0.48	0.630	
Respondent lived alone	-0.05	2.22	-0.02	0.983	
Respondent is on a continuing scholarship	2.37	1.18	2.01	0.047	*
Respondent is a racialized minority or Indigenous	-0.79	1.87	-0.42	0.676	
Respondent is a first-generation student	-1.24	1.54	-0.80	0.425	
Respondent has English as an Additional Language (EAL)	-2.83	1.65	-1.72	0.090	.
Respondent was 25 years or over	7.18	3.15	2.28	0.025	*
Respondent did not always have access to food	-1.09	1.33	-0.81	0.418	
Respondent was housing insecure	-2.22	2.34	-0.95	0.345	
Independence of Learning Measure	0.55	0.23	2.43	0.017	*
Study Habits Measure	1.84	0.36	5.06	0.000	***

Note. $N = 96$, R-squared = .4947; Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Beyond the effect of instructional mode, several other results from the regression are also very interesting. Surprisingly, the indicator for whether the student did not always have access to food to meet their needs and preferences was not statistically significant. This may be a result of the fact that our question used a very broad definition which may have overestimated actual food insecurity. Our indicator of whether a respondent was housing-insecure also did not seem to have a significant effect on engagement but this is probably due to the limited number of survey respondents who indicated they were housing insecure. Reassuringly, unlike other studies, we do not find that gender identity has a significant effect on engagement (Thill et al., 2016). It is also encouraging that students who identify as racialized or Indigenous and first-generation students do not appear to have statistically different skills engagement levels from their classmates. Living alone and being employed full-time also did not seem to affect skills engagement levels suggesting that these environmental situations do not necessarily impact students' ability to engage with their classes.

There were however some demographic variables that did seem to affect engagement. For example, students who were on scholarship or who were mature (age 25 or above) seem to report statistically significantly higher engagement skills. Reported average engagement was 2 points higher for students who have a continuing scholarship and over 7 points higher for mature students holding all the other variables constant. This finding is not surprising as both scholarship and mature students are likely to be more invested in their education—scholarship students because they do not want to lose their scholarships and mature students because they sacrifice more in terms of foregone wages than their younger classmates, have more academic emotional maturity, and have developed more intrinsic motivators for learning (Muir et al., 2019; Wyatt, 2011).

As predicted, independence of learning and study habits have a statistically significant positive relationship with reported levels of skills engagement although whether this is causal or because the two concepts are measuring similar traits is unclear. Students who report being good at meeting deadlines and who claim they do not frequently find excuses for not getting down to work are likely also those with high skills engagement. A one-point increase in study habits is associated with an almost 2-point increase in average skills engagement holding all else constant. The effect of independence of learning is smaller at only 0.5 but is still significant at the 5% level.

The only other variable that is marginally statistical significance (significant at the 10% level) was an indicator of whether the student has English as an Additional Language (EAL). According to our results, after controlling for the other variables in our analysis, EAL students report an almost 3-point lower level of skills engagement. This is alarming as it suggests that students whose mother tongue is not English might not be engaging as much as their fellow students and as a result might not be getting as much out of their education.

What Do Students and Faculty Say Affects Engagement?

Simple multivariate analysis of measurable variables including teaching mode is unable to capture everything that affects student engagement. Fortunately, we have qualitative data from two open-ended survey questions asking students what encouraged and discouraged them from engaging with their class and/or its topic and faculty interview data. While not all students answered the survey about factors affecting engagement, some respondents provided significant details in their answers. In total, 102 respondents indicated what had encouraged them and 101 indicated what they found discouraged them. These responses range from very specific details about how their class unfolded to more general comments about the types of teaching tools that instructors used. Some interesting details were uncovered while analyzing these responses. We used a content analysis approach to code this qualitative data. Any code that was repeated more than once is reported in Table 6: What Students Report Encouraged or Discouraged Engagement. Unfortunately, the small sample size for each reference code means that we cannot disaggregate by teaching modality while simultaneously maintaining respondent confidentiality. In our continued research, we will be examining this in further detail.

Table 6

What Students Report Encouraged or Discouraged Engagement (in Order of Frequency)

Encouraging (counts)	Discouraging (counts)
Assignments (21)	Assignments (16)
Course topic (10)	Video lectures (8)
Quizzes (9)	Course topic (5)
Labs and lab assignments (8)	Forum Posts/Discussion boards (5)
Forum Posts/Discussion boards (7)	Labs and lab assignments (5)
Tutorials and help sessions (5)	Quizzes (3)
Worksheets (4)	Too much work (2)
Group projects (4)	
Participation grades (3)	
Questions embedded in the lecture (3)	
Passionate or accommodating professor (2)	
In-person (2)	
Video lectures (2)	
Podcast (2)	

The first column of Table 6: What Students Report Encouraged or Discouraged Engagement indicates which course aspects students report encouraged them to be interested in their class and/or its topic. The most popular response was assignments. In particular, students indicated that regular assignments, assignments with lower weight, and assignments that allowed choice could be effective at encouraging them to be interested in their class. Students said that assignments "made me read the textbook," "forced me to engage with the class material every day," and "made me stay on top of the class." Clearly, properly designed assignments can be an effective tool to engage students.

Other instructional tools that encouraged engagement included quizzes, labs and lab assignments, and discussion forums. Respondents seemed to find regular low-stakes quizzes effective for engagement saying things like "quizzes were a great tool to keep on track with the course content on a weekly basis." Students also indicated that labs and lab projects were useful with one person even saying that they "learned a lot from it." Forum posts were the next most frequently identified course aspect for motivating engagement. Students said that forums were "interesting" and that they "made me think more about each topic." Taken together with assignments, these course aspects helped encourage students to "engage more with the content." Fewer students mentioned that group projects, participation grades, and video lectures were instructional aspects that encouraged engagement.

Interviews with instructors made it clear that they viewed regular assignments quizzes, labs, and forums as useful tools for engaging students. What was also clear is that these tools were best implemented if there were sufficient resources allocated for teaching assistants. One faculty indicated that having TAs enabled them to offer "lots of small low-stakes assignments" because they "could have the TAs do way more of the grading." It was also clear that faculty were overwhelmed with the amount of work needed to transition to online instruction and that additional support, including funding for TAs, would have been helpful.

The course topic was the second most frequently cited source of engagement; one student indicated, "I was intrigued/encouraged by the info and lectures" while another mentioned that the class topic was "directly relevant to me and many of my peers." Along a similar line, the professor

was a source of engagement with students indicating that "passionate" and "accommodating" professors who gave them "lots of opportunity to succeed" encouraged them to engage with their courses. Tutorials or help sessions were also identified as helping engage students; one student said that "tutorials helped immensely."

It was also interesting to note that two students mentioned that the fact their course was offered in-person encouraged them to be interested in their class suggesting that some students did perceive in-person classes as being more engaging even though we did not observe this positive effect in our quantitative analysis. That students believe they were less engaged online is a concern as this perception might discourage them and reduce their performance. Unfortunately, perceptions are difficult to quantify and compare so we opted to use a behaviouralist measure of engagement. It is also important to note that two responses do not represent a significant population and this limited sample size does not allow us to disaggregate these results in a way that we can determine the precise mode of course delivery. It is perhaps more striking that so few students refer to teaching modality as affecting engagement.

Although certain attributes of a course supported student engagement, other aspects may have discouraged interest. When asked what aspects of their class discouraged them from being interested in the class and/or its topics, a plethora of responses were given. While some aspects were identified by multiple students, there was less congruence between responses. Ironically, some of the top aspects that were encouraging also ranked highly on the discouraging list. For example, 16 of 101 students indicated that assignments were discouraging saying that there were "too many large writing assignments," that assignments were worth too much, and that "assignments are too hard to be worth so little." Clearly, the details matter; instructors need to balance between enough challenging assignments to motivate students and not having too many hard assignments to discourage students.

Eight out of 101 students reported finding video lectures discouraging. This is unfortunate as the online format lends itself well to video lectures and, in asynchronous online courses and hybrid courses, these videos are substituted for regular in-person lectures. Since the transition to online instruction was undertaken in a hurry because of COVID restrictions, some faculty reported in their interviews that there was limited time and support for the development of quality videos. Students report that some videos were "too long" and "dry" making them hard to "deal with effectively" suggesting that the design of the videos matters. Further study will be needed to determine if certain video formats are more effective at engaging students. It should also be noted that in face-to-face classes, lecturing is also considered disengaging (Baron et al., 2016). Thus, it may be the nature of lecturing, rather than delivery mode, that is the characteristic of note.

The next item that makes an appearance on both the encouraging and discouraging lists is the topic of the course. Several students indicated that, since they were not interested in the course topic, they were discouraged from being interested in their class and/or its topics. Unfortunately, many instructors do not have control over the topic of their course. A major challenge seems to be that students had to take courses for distributional requirements; one student indicated that "I'm only taking this class because [my university] forced me to (sic) in order to get my degree." This raises a larger issue about requiring students to take certain courses for distribution requirements which is an issue beyond the scope of this analysis.

Another instructional aspect that was found to both encourage and discourage engagement was forums/discussion boards. It seems that some students found discussion boards "impersonal" and "intimidating." People "not replying to the forums in a timely manner" as well as the "overwhelming" number of emails received seem to have made discussion boards ineffective. It is

unclear whether the problem is the design and implementation or whether some students found forums and discussion boards encouraging while others found them discouraging. Teaching students how to effectively use these forums might prove fruitful.

Labs and quizzes were also able to both encourage and discourage engagement. Students appear to have found certain labs difficult, especially those that required computer programming. Some form of support for students who struggle in labs might be found with the assistance of more qualified teaching assistants (TAs) and lab instructors. Quizzes also seem to be polarizing, with one student suggesting they "would have liked more online quizzes rather than assignments" while another found that "quizzes were hard due to the online format." Training students on how to work with the online format could resolve the latter complaint.

The final issue raised by several students was that there was "too much" to do in the courses. Whether it was too much homework or overly long readings, students agreed that this discouraged them from engaging with the course. Based on preliminary information from our faculty interviews, the issue of workload was identified as being an important factor that could affect student engagement. Based on this suggestion, we included two questions in our survey about workload. When asked about the workload for this course compared to other university courses, less than a quarter of the respondents indicated that they disagreed or strongly disagreed with the statement that the workload was reasonable. When it came to the question about the workload in all their 2020 fall courses, over 47% of the respondents indicated that they disagreed or strongly disagreed with the statement that the workload for all courses this term (fall 2020) was reasonable. This does suggest that students were feeling overwhelmed with work during the 2020 fall semester but it is not clear if this situation was usual, unusual due to COVID, or related to how courses were being taught. Also, since there were many first-year courses in this analysis, students might not have sufficient perspective to answer this question reliably.

How Might COVID have Affected Engagement?

One issue with studying engagement during COVID is that engagement is likely to have been affected by the stress of trying to learn during a global pandemic. To examine this issue student respondents were asked whether COVID-19 affected their ability to engage in their class. We used a Pearson chi-squared test, which is a valid test for comparing two sets of categorical data, to determine if there were significant relationships between COVID's effect on students' ability to engage and teaching mode. We conclude that there is no significant relationship between COVID's effect on students' ability to engage and teaching mode.[7] While engagement levels might have been higher for all modalities in the absence of COVID, our data suggest that there are no differences between modes.

To get more information about the effect of COVID, we asked an open-ended question about how COVID affected students' ability to engage in their classes. We obtained 111 responses to this question, some of which were quite detailed. Several students indicated that it was harder to engage in classes that were offered online. Even in-person classes were not ideal. One student said, "I also did not see one familiar face in the room" while another said that "since we had to wear masks, I didn't feel comfortable speaking out in class." Generally, the feeling appears to have been that engagement was harder because of COVID and that it was hard to stay motivated in

[7] Comparing responses to this 5-point Likert scale question across the 7 teaching modalities, we obtained a Pearson chi-squared statistic of 13.096. With 36 degrees of freedom, the p-value was 0.7009 meaning that we cannot reject the null hypothesis that the distribution of responses is the same for all 7 modes of teaching.

online classes. This is surprising because it does not correspond with the results that we obtained using our behavioural measures of student engagement. It is possible that overall engagement was lower because of COVID but this seems not to be specific to the mode of course delivery.

It also is worth noting that nothing was "normal" during the 2020 fall semester. Courses taught in-person were held in large classrooms that allowed social distancing and students were required to wear masks in all public areas on campus. Both these issues may have adversely affected students' experiences even when their courses meet in-person. Since close interactions both inside and outside class were seriously curtailed, it is likely that students did not have the ideal environment for studying and engaging with their courses. Whether any of this affected reported engagement is not clear but what is clear is that getting high engagement in asynchronous online courses is possible.

How Has This Study Improved Our Understanding of Student Engagement?

This work is unique because we exploit a natural experiment that produced quasi-experimental data. Using multiple survey questions about student behaviours, feelings, and attitudes, we constructed three measures of engagement (participation, skills, and affective) and, when we compare these measures of engagement across teaching modalities, we find that teaching mode does not have the predicted effect on engagement--most measures of engagement are the same across the different teaching modes with the exception being that skills engagement was higher for courses offered asynchronously online. This data suggests that (for our population) the hypothesis that students are more engaged when they interact in-person with their instructors and classmates is unsubstantiated.

Our limited sample size and the unique characteristics of the university in this study make it difficult to make sweeping generalizations but we conclude that asynchronous online classes can be designed to support engagement even under emergency and adverse conditions. This naturally raises the question of what specifically can be done to encourage engagement. Some insights are available from open-ended survey questions and our preliminary analysis of faculty interviews.

As the analysis above indicates, the use of regular assignments, assignments with lower weight, and assignments that allowed choice could encourage higher skills engagement. Weekly personal reflections and lab assignments, regular contact, as well as support from TAs were also identified (by the SSE open-ended questions and faculty interviews) as important factors in supporting student engagement. Our results also make it clear that instructors need support in designing effective and engaging online courses. Whether it is in the form of assistance with creating online content and videos or funding for TA or lab instructors who can facilitate forums and lab sessions, institutions will need to invest time and money to ensure that online instruction is engaging.

Our findings are particularly informative because the data we collected was quasi-experimental. Since students had little choice about how their courses were offered, we can conclude that the differences observed are not due to unobservable characteristics of students but a result of the teaching modalities. This type of work is particularly important if institutions hope to expand their online offerings to a broader set of students than those who have traditionally opted for online instruction.

Given the variety of teaching modes observed in our study, we have a snapshot of how in-person classes compare with those offered online. This work is particularly important because students' engagement is even more critical for asynchronous online classes (Buelow et al., 2018).

Dixson (2015) agrees that engagement is particularly important to student learning in online environments where students can often feel isolated and disconnected. As with any distance learning, online learning requires more self-discipline and initiative on the part of students (Bawane & Spector, 2009; Bejerano, 2008; Bonnel, 2008; Buelow et al., 2018; Fein & Logan, 2003; Volery & Lord, 2000). The fact that we find skills engagement to be high among asynchronous courses suggests that students were able to overcome the hurdles of being self-disciplined and disconnected.

Our study is also unique in that we incorporated a variety of respondent characteristics to control for potential variation of these traits across the courses. Incorporating independence of learning and study habits was a particularly novel way to try and control for exogenous student characteristics that may affect engagement. This allows us to be more confident that the effects we see on engagement resulting from teaching mode are not an artifact of missing information.

Our answers are not definitive, but this research indicates that faculty can design asynchronous courses in a way that engages students. As with any study using survey reports, we rely on respondent's ability to accurately recall and report their behaviours. That said, anonymity and the use of Likert scales and open-ended questions support the validity of our research. There is also the possibility that our sample is biased because less engaged students did not complete the survey, because our faculty participants were not typical, or because the institution at which we undertook our study is not representative of post-secondary educational institutes. However, data on respondent characteristics does suggest that our respondents look like the population under examination. While our faculty participants and the institution under examination may be unique, the information we collected does offer some generalizable insights. The fact that our faculty participants were likely those with an interest in SoTL means that they are knowledgeable about effective teaching strategies and are likely to be more proactive in designing their classes to support students and student engagement. While the institution in this study is naturally unique, it seems that if something can be done at one institution it might be replicated at others.

Our work makes it clear that the path to engagement is about more than whether the class is offered online or face-to-face. Instead, we find that the details of how the class is taught are important. Instructors who want to engage their students need to consider the learning opportunities provided, the course communication approaches, and the occasions for connections among students. More support from the administration and more time to prepare would help to ensure that online courses are more engaging, effective, easier to navigate, and attractive. In conclusion, it appears that teaching modality is less important to engagement than the quality in instructional technique.

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