2023 UM-Dearborn Strategic Priorities for Course Scheduling and Modalities

Data Appendix

As UM-Dearborn considers how to strategically approach course scheduling, using diverse modalities as a key tool for increasing flexibility and accessibility, there may nevertheless be questions about whether increasing the use of online and hybrid modalities is feasible or desirable. This data appendix addresses these potential questions, and concludes that yes, it is feasible and desirable to use a wider range of modalities in course scheduling.

For additional data on student needs and preferences, please see the Fall 2022 Student Experience and Student Needs Survey quantitative and qualitative reports.

1 Summary of Analysis

1.1 Overview of Findings

An analysis of course offerings and enrollment data from Fall 2010 through Winter 2022 shows a clear increase in online and hybrid offerings, and a clear demand from students for these modalities.

The following provides high-level observations from the data analyzed.

- UM-Dearborn faculty across all four colleges were offering greater numbers of online and hybrid courses prior to the pandemic (see Section 3), and that pattern has strengthened since the pandemic. At the same time, **demand for online and hybrid courses has remained high, on average relative to in-person courses, for undergraduate students and largely for graduate students** (see Section 4).
- While there is some variation in demand on a course-by-course basis, the anecdotal narrative that students prefer in-person courses over online and especially hybrid courses is not borne out in the evidence (see Section 5). **When UM-Dearborn offers online and hybrid courses, students generally enroll in them at higher or similar rates as in-person courses** (see Sections 4 & 5). The only time when that pattern has reversed in recent years has been at the height of the pandemic, when almost no courses were offered in person, and those in person courses had extremely low course capacities (see Section 4).
- At the same time, many faculty have experience offering online and hybrid courses, — even in the absence of the pandemic — (see Section 6). This experience has intensified with the pandemic, with many more faculty continuing to teach online and in

hybrid modalities, which implies an opening for increased online and hybrid offerings by more faculty.

Together, this data indicates that there is room for the UM-Dearborn campus to take a strategic approach to course offerings, by using online and hybrid course offerings going forward.

1.2 Overview of Each Section

- Section 2 presents an overview of the methodological choices we are required to make when analyzing trends in course modalities, because of the structure of campus course data. And the data differs depending on exactly which data is pulled, by whom, and from which campus data pool. One core issue is that much campus data is structured around sections, which do not distinguish between *sections* and *courses*. While at the aggregate level the differences are relatively small, they have complex implications when assessing fill rates and enrollments at the course level. This section clarifies the different approaches to measuring courses using campus data, and when each might be more or less appropriate, using visualizations of undergraduate online/hybrid offerings and student enrollments, from Fall 2010 through Winter 2020.

- Section 3 summarizes trends in pre-pandemic online offerings and enrollments, from Fall 2010 through Winter 2020. The visualizations show that while the proportion of undergraduate online and hybrid sections and enrollments were trending upwards before the pandemic, they did not (together) fully reach the campus goal of 20% online/hybrid (CEHHS being a notable exception). **In all colleges, there has also been a clear upward trend in both online and hybrid undergraduate offerings, with a sharp acceleration beginning between 2015 & 2018. In contrast to undergraduate offerings, all colleges had met or surpassed the 20% goal for *graduate* online/hybrid sections by Winter 2020.**

- Section 4 examines trends in fill rates for in-person vs. online/hybrid courses, from Fall 2010 through Winter 2022. At the aggregate level, this data is extremely clear: average fill rates for undergraduate online/hybrid courses have been consistently higher than average fill rates for in-person courses in COB, CASL, and CEHHS. While average fill rates for in-person undergraduate courses were higher for CECS from 2010-2018, the average fill rates of online/hybrid courses trended steadily upwards from 2015, and surpassed the average fill rates in 2018-2019 (prior to the pandemic). **This implies that – on average – online courses enroll as well or better than in-person courses, across the university.** This points to latent demand for online courses that is not currently being met. There is obviously a ratio of online to in-person courses that would tip the balance (as can be seen in 2020-2021, when the number of in-person courses was extremely low, and many of those courses had lower than normal course caps); but the campus has not yet hit that point, not even with the relatively high number of online courses offered in 2021-2022. The figures in this section show these trends both by year

and by term, and provide contextual information on both the number of courses offered and the average course capacities to put the average fill rates into context. At the graduate level, we see that COB and CEHHS have had consistently higher fill rates for online/hybrid courses, while this has only occurred since 2017 for CECS. CASL is an outlier with consistently higher fill rates for in-person graduate courses.

- Section 5 examines trends in average fill rates for individual courses that were offered *simultaneously* in at least two modalities in a single term, at least once, from Fall 2010 to Winter 2022. By looking at individual courses, we can see the choices of similarly situated students when provided the opportunity to choose between modalities for fulfilling a similar requirement. Across all four colleges, we can see that the overall trends (seen in Section 4) largely hold at the level of individual courses as well. **While there is some variation from course to course, it is clear that fill rates for online, and even hybrid courses, are generally higher than (or at least even with) fill rates for in-person courses.** This pattern holds whether or not online and hybrid courses have lower or similar course capacities to the in-person versions of the course. This indicates that there is still pent-up demand for more online and hybrid offerings.

- Section 6 examines trends in faculty experience with offering online courses, by calculating the proportion of the faculty in each college that offer in-person, online or hybrid courses each year. As the modalities for undergraduate vs. graduate offerings differ between colleges, we see real differences in the proportion of faculty with experience teaching in each modality over time. Pre-pandemic, it is clear that almost all faculty in all four colleges taught at least one course in person. Therefore, faculty who offered online or hybrid courses were also simultaneously teaching in-person courses. At the same time, the proportion of faculty teaching any course online (whether undergraduate or graduate) in all four colleges remained fairly static from 2010-2019, with some variation from college to college. **This implies that the increase in online offerings during the 2010-2019 period may have been driven by an increase in online courses offered by faculty who were already teaching online, rather than an increase in new faculty teaching online.** Obviously, the pandemic has completely upended these proportions, with almost all faculty teaching online in 2020-2021, and a still much higher proportion of faculty teaching at least one class online in 2021-2022, even while they were once again offering in-person courses. A similar pattern (albeit starting at a much lower level) can be seen for hybrid courses. This indicates a real shift in the proportion of faculty that could potentially offer online and hybrid courses in the future.

1.3 Table of Contents

2 Methodological and Analytical Choices

There are several methodological and analytical choices made across this appendix, and it is worth explaining them in some detail to put the figures and analysis into context.

2.1 Counting Online and Hybrid Offerings

First, we focus on multiple aspects of the campus' online offerings: courses offered, students enrolled, fill rates, etc. By looking at the data from different angles, we can better understand the role different modalities have played for our students and our curriculum.

To visually see these methodological differences, this first substantive section of the appendix focuses specifically on two of these measures: courses offered and student enrollment. For example, by looking at courses offered, we can get a sense of the proportion of courses we have designed and delivered in online modalities (including both fully online and hybrid courses, as specified in the 2017 Digital Education Strategic Priorities plan). This allows us to consider the structural importance of online courses for our curriculum. In contrast, by looking at students enrolled in online courses, we can gain a clearer picture of how many students have actually taken online courses. Student enrollments can be assessed in the aggregate (i.e. total enrollments across courses), on average (i.e. average enrollments across courses) , and relative to course capacities (i.e. average fill rates across courses).

These two measures (course numbers & enrollments) are not necessarily capturing the same thing. For instance, we might offer very few courses online, but those courses might have a high seat capacity and enroll a significant number of students (this would imply a narrow impact on curriculum, but a much wider impact on our students). This pattern might be more likely to occur if we offered lower division courses or popular DDC courses online. In contrast, we might offer many courses online, but those courses might have a low seat capacity and enroll relatively few students (this would imply more courses online in our curriculum, but without as wide an impact on our student body). This pattern might be more likely to occur if select programs offer upper-division electives online, for example.

Importantly, the online course and student capacity distinction also implies that while enrollment and courses offered may trend together, we would not necessarily expect them to be exactly the same (as they are measuring different things). Note that enrollments count the total number of enrollments across courses, and *not* the total number of students taking classes at UM-Dearborn. This means that a student who is enrolled in four classes would be counted four times within this data, while a student who is enrolled in two classes would be counted twice.

2.2 Counting "Courses" Using Data Structured by Sections

Second, it is important to note the structure of the data available to us here. Our campus data on course offerings is structured by ***section***. This means there is no way to easily distinguish

between stand-alone courses and cross-listed courses, and it can be complex to make meaningful distinctions between courses with a single section and courses with multiple sections.

To try to assess the proportion of ***courses*** offered online, therefore, it is useful to aggregate the data in several ways, which allows us to triangulate across different units of "courses" and gain a more nuanced (and potentially interpretable) understanding of our online offerings. There are three different aggregate units of "courses" used here: by section, by course name (+ instructor), and by course number (+ subject).

- The *sections* measure aggregates across the number of individual sections offered each year. This approach makes no distinction between sections of cross-listed courses or separate sections of the same course name/number. Each section is considered a separate course and counted individually. In technical terms, prior to calculating the total number of (online) courses and enrollments per year per college, the data is grouped by academic year, college, course level (undergrad vs. grad), and delivery type (in person vs. online + hybrid).

- The *course name* measure aggregates across course names AND instructors AND section numbers. This approach collapses all sections offered under the same name and section number in a single term with the same instructor in the same college. Therefore, this approach counts all cross-listed sections that have the same course title and instructor and section number as a single course (when there are multiple sections of a cross-listed course they usually all have the same section number, and they definitely all have the same instructor). The approach taken here does NOT collapse courses that are cross-listed across colleges (i.e. a single course cross-listed between CASL and CECS will show up as two different courses here). In technical terms, prior to calculating the total number of (online) courses and enrollments per year per college, the data is grouped by academic year, college, course level (undergrad vs. grad), and delivery type (in person vs. online + hybrid), as well as semester, course name, section number, and instructor.

- The *course number* measure aggregates across course subjects AND numbers. This approach collapses all sections of the same course with the same subject code and course number. However, this approach considers each cross-listed subject/number as a separate course. In technical terms, prior to calculating the total number of (online) courses and enrollments per year per college, the data is grouped by academic year, college, course level (undergrad vs. grad), and delivery type (in person vs. online + hybrid), as well as semester, subject code, and course number.

Note that the data used here does NOT include lab sections.

2.3 Normalizing Measures for Comparison Across Colleges

Third, data is normalized across colleges when we focus on the proportion of courses offered in online modalities and the proportion of total enrollments in those classes. By focusing on proportions, we can assess increases or decreases in online offerings and enrollments over time, relative to the previous Digital Education Strategic Goal (20%).

2.4 Aggregating Data by Year for Ease of Visualization

Finally, the data here is aggregated by year for many figures (though the counts themselves distinguish classes by term). This is because there are fairly large differences across semesters in terms of the number of courses offered (i.e. Fall vs. Winter vs. Summer), and mode of delivery (i.e. a higher proportion of Summer classes have usually been offered online). This makes it difficult to easily visualize the data by term (i.e. the figures are quite messy to look at and it's hard to see patterns). Aggregating the data by year makes it possible to eyeball the overall trends, without being distracted by smaller shifts in proportions from term to term.

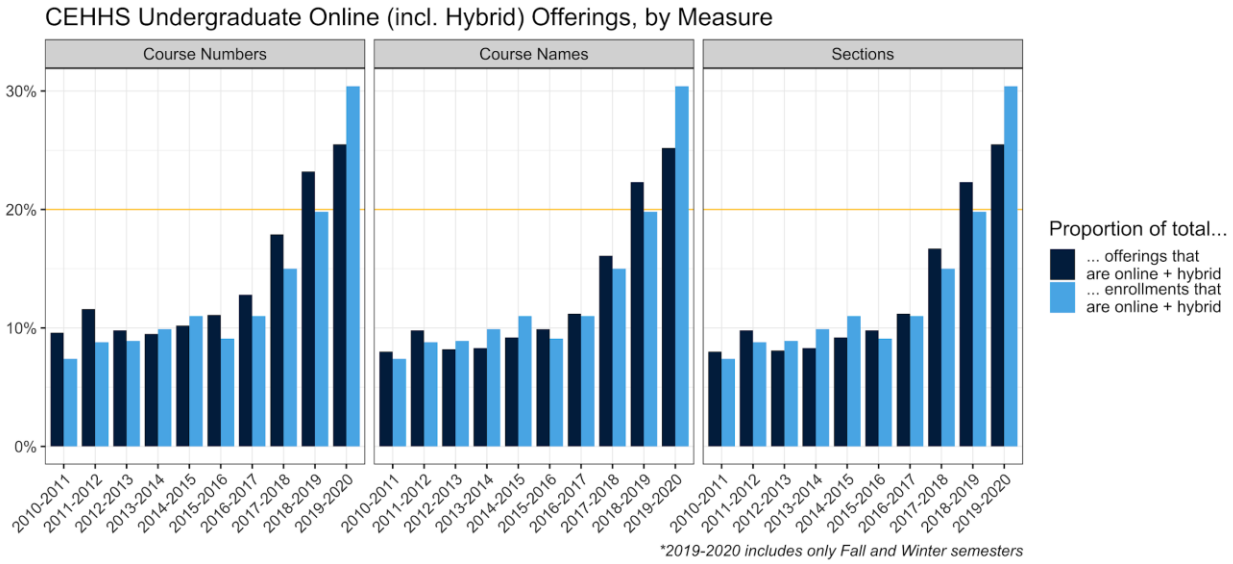
2.5 Comparison of Combined Online & Hybrid Offerings Across Different "Course" Measurements

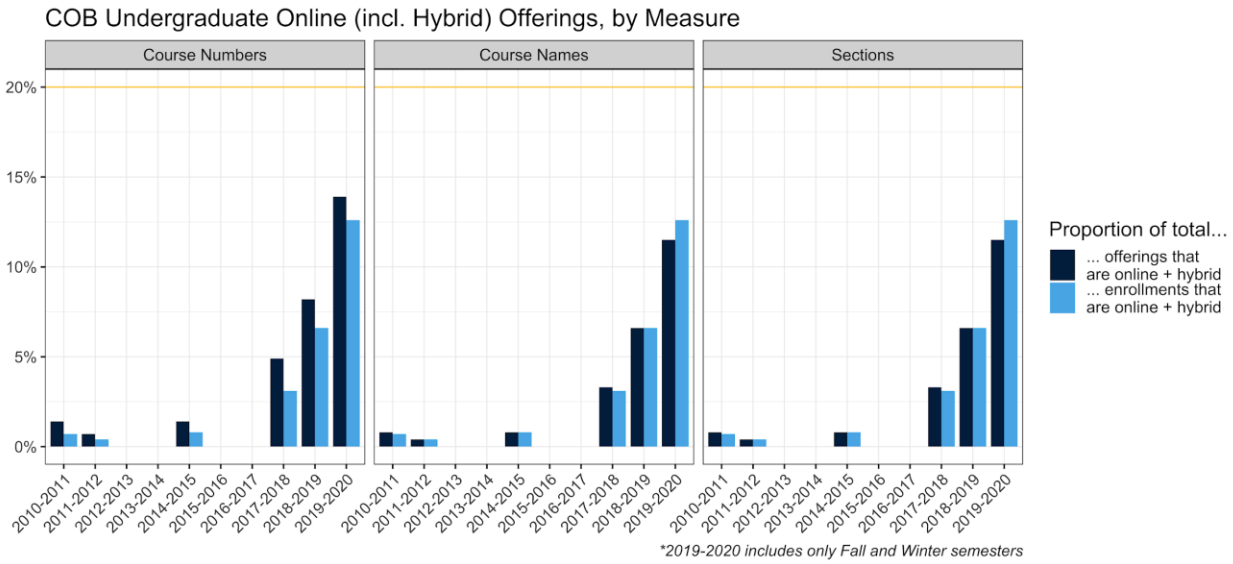
For clarity, it is helpful to begin by comparing the trends over time across the three different methods of counting "courses". This provides a clearer view of how the different approaches relate to each other and to enrollments.

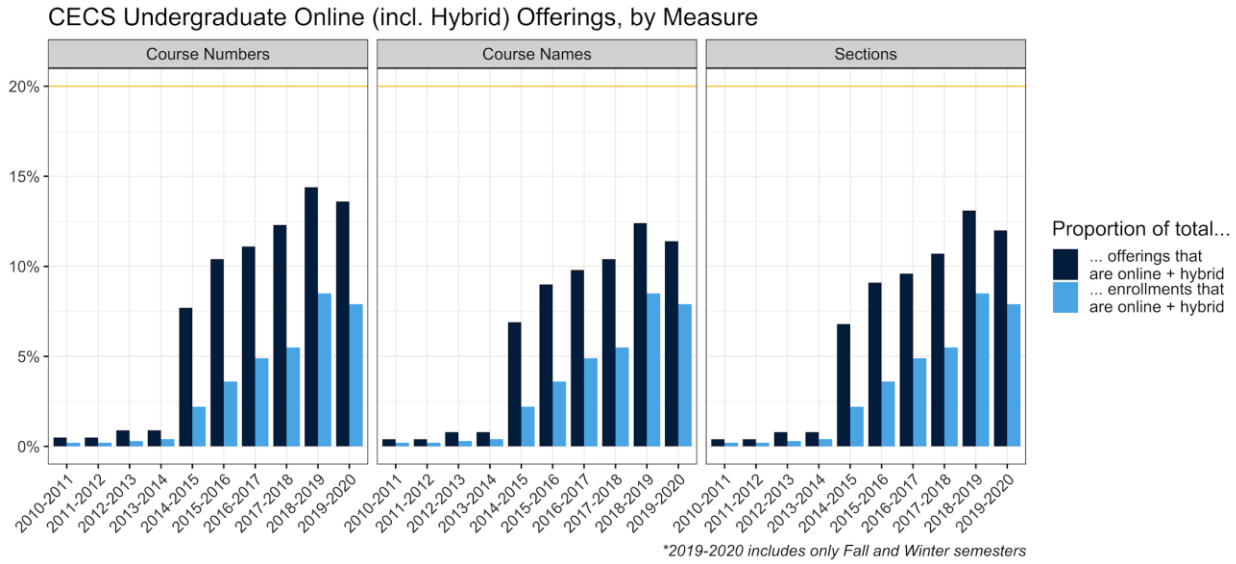
The figures below (one for each college) show the proportion of total undergraduate course offerings that were online (including both online & hybrid courses): counted by sections, by course names, and by course numbers (see above for explanations of each approach). The enrollment measure shows the proportion of total enrollments that were in online courses. Please note that the y-axis is <u>not</u> the same across these four figures.

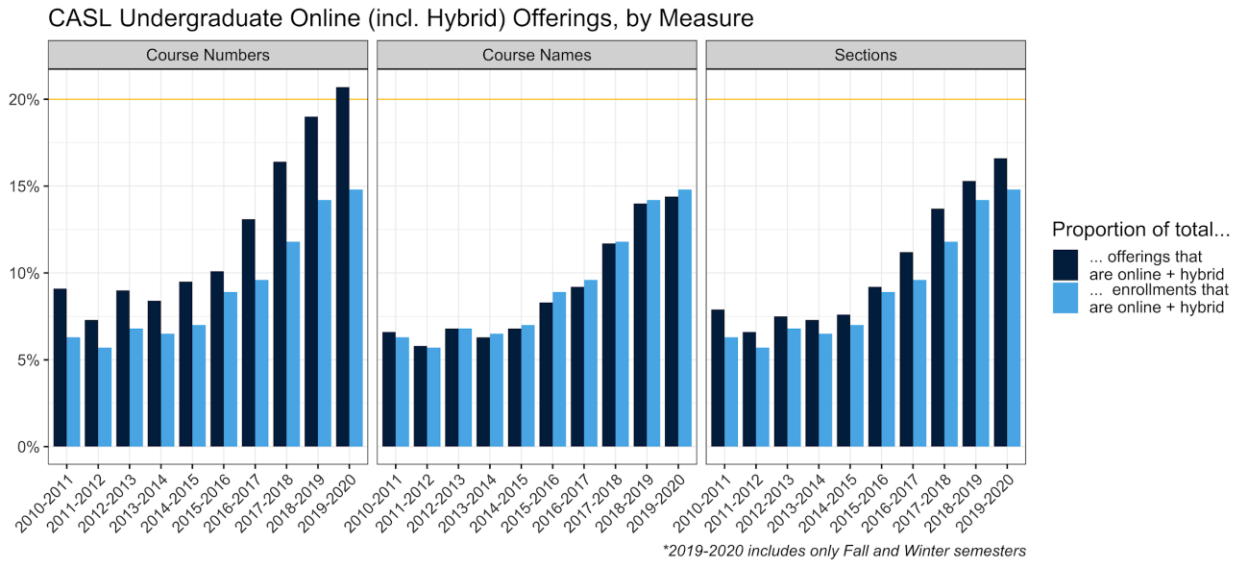
What we see first in the figures is that the proportion of online enrollments stays the same, regardless of how courses are counted. If students were enrolled in an "online" or "hybrid" section, those enrollments are counted as online. This makes sense, as the *total* number of students enrolled in online courses does not change regardless of how those students are distributed across different "*course*" counts

In contrast, the proportion of "courses" does change, depending on whether we are looking at the proportion of total sections that were offered online, the proportion of total unique course names (identified by course name and instructor and section) that were offered online, or the proportion of total unique course numbers (identified by subject and course number) that were offered online.


CEHHS Undergraduate Online (incl. Hybrid) Offerings, by Measure
Course Numbers
Course Names
Sections
30%
20%
10%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
*2019-2020 includes only Fall and Winter semesters
Proportion of total...
... offerings that are online + hybrid
... enrollments that are online + hybrid


COB Undergraduate Online (incl. Hybrid) Offerings, by Measure
Course Numbers
Course Names
Sections
20%
15%
10%
5%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
*2019-2020 includes only Fall and Winter semesters
Proportion of total...
... offerings that are online + hybrid
... enrollments that are online + hybrid





Across all colleges, the number of total “courses” is greatest when measured by sections, and smallest when measured by course numbers. However, there are structural differences across colleges in how often multiple sections of the same course are offered (which compresses the the number of “courses” when using course numbers), and how often cross-listed sections of the same course are offered (which compresses the number of “courses” when using course names).

Total Undergraduate Courses (All Modalities), Fall 2010 - Winter 2020, by Measure

College Code	by Course Numbers	by Course Names	by Sections
CEHHS	1,832	2,151	2,160

College Code	by Course Numbers	by Course Names	by Sections
COB	1,475	2,677	2,677
CECS	2,640	2,960	3,034
CASL	10,978	14,420	17,340

This also means that the number of online "courses" offered also differs depending on the structure of online courses within the curriculum (i.e. cross-listed, multiple sections, etc). While the pattern across all the colleges is identical when calculating total numbers of courses in general (sections > course names > course numbers), this is NOT the case when calculating the number of *online* courses. When counting online courses (not sections), the patterns shift slightly from college to college. Sometimes using course numbers provides a larger count than course names, and vice versa. Again, this is likely due to a different pattern in the *types* of courses offered for online courses in each college, compared to the patterns for courses in general (i.e. more or fewer cross-listed courses, more or fewer courses with multiple sections, etc.).

Total Online + Hybrid Undergraduate Courses, Fall 2010 - Winter 2020, by Measure

College Code	by Course Numbers	by Course Names	by Sections
COB	46	65	65
CECS	210	207	217
CEHHS	263	275	278
CASL	1,322	1,274	1,750

For example, for calculating proportions in the figures above, CASL has the fewest online courses when aggregating by course names (smallest numerator), but the fewest total courses when aggregating by course numbers (smallest denominator). In contrast, CECS has very little difference in total number of online courses, regardless of measure, with much wider variations in total courses by measure. These variations in total numbers cause the overall proportions to vary differently across colleges for each measure.

However, it is also evident from the figures that there is relatively little difference in results when aggregating by these different measures (roughly, no more than 5% variation for proportions of undergraduate course offerings, with the exception of the difference between using course numbers and course names in CASL). While these small differences might matter if we were attempting to run statistical analyses, they are probably negligible for identifying general

patterns over time. And we can easily see that the general patterns of increases or decreases in online offerings hold over time, regardless of the exact measure. In other words, the broad trends remain the same, even if the exact proportion of "courses" varies. This suggests that it is possible to use the aggregate measure that is most appropriate for a particular question (i.e. what are average course-level fill rates?), rather than using the exact same measure throughout this appendix.

3 Trends in Pre-Pandemic Online Offerings and Enrollments

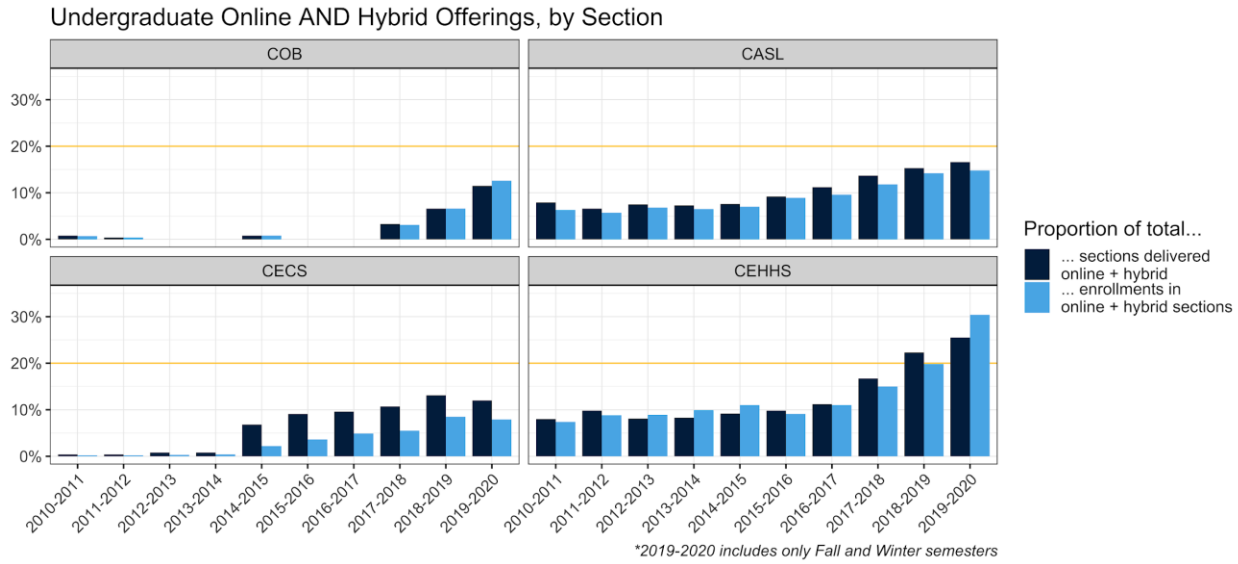
To understand where the University of Michigan-Dearborn's online offerings stood prior to the pandemic, it is helpful to look at the data over time. The following visualizations focus on yearly data from Fall 2010 through Winter 2020 (the last semester whose course offerings were set without reference to the pandemic).

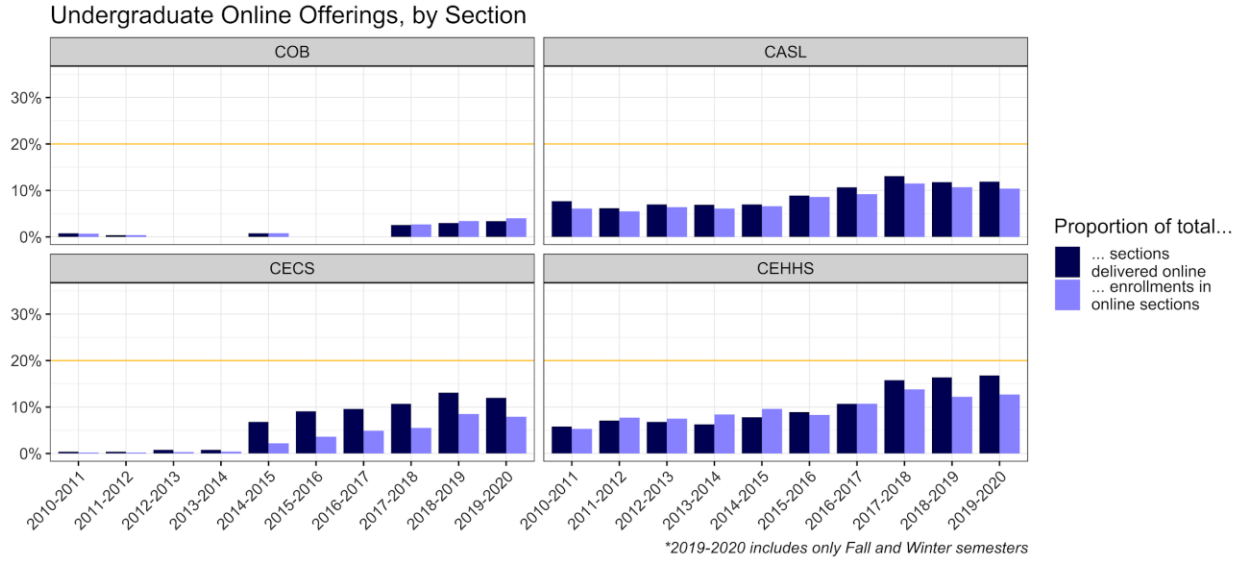
3.1 Trends in Offerings, By Section

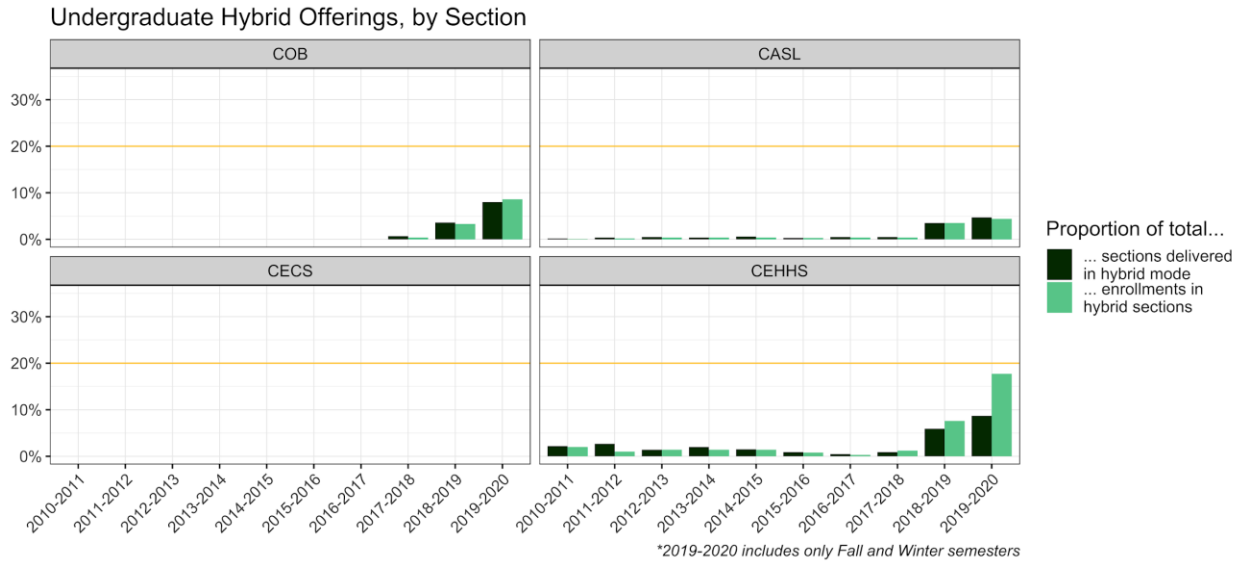
Given that the above comparisons show relatively minor differences between the three methods for counting numbers of "courses," the following figures use only the sections measure to show trends for undergraduate and graduate courses in online and hybrid mode. This is simply because the original data is structured by sections, and therefore it is most likely to mirror data analysis others have already conducted on campus.

3.2 Undergraduate Offerings and Enrollment, by Section

The following figures show trends over time in *undergraduate* offerings and enrollments for online and hybrid courses, both combined and separately. **Please note the yellow horizontal line at 20%** marking the 2017 Digital Education Strategic Goal for online & hybrid course offerings.


Undergraduate Online AND Hybrid Offerings, by Section
COB
CASL
CECS
CEHHS
30%
20%
10%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
*2019-2020 includes only Fall and Winter semesters
Proportion of total...
... sections delivered online + hybrid
... enrollments in online + hybrid sections


Undergraduate Online Offerings, by Section
COB
CASL
CECS
CEHHS
30%
20%
10%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
*2019-2020 includes only Fall and Winter semesters
Proportion of total...
... sections delivered online
... enrollments in online sections

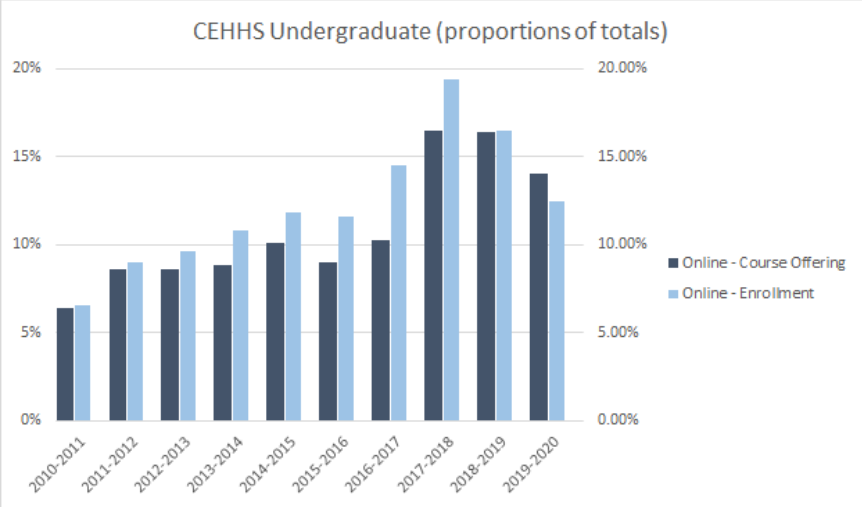


These trends in undergraduate offerings indicate — as shown in the previous section — that our combined online + hybrid offerings have increased over time in all four colleges. While only CEHHS reached the 20% goal, the other colleges have been moving in that direction. Interestingly, in the most recent years, there appears to have been a small plateau in fully online offerings as hybrid offerings have increased, suggesting, perhaps, a pre-pandemic shift in focus by faculty interested in providing alternative modalities.

3.2.1 Undergraduate Trends, Using a Different Data Set

It is also worth noting that there are different data sets used across campus, and they do not all align perfectly. The following tables offer a similar presentation of undergraduate online offerings and enrollments, using a data set that takes official crosslistings (xlist_code) into account, presenting all cross listed CRNs as one single course. This changes the view of course offerings, but enrollments should be unaffected.

Comparing the figures for each college's undergraduate online course offerings (as a proportion of total course offerings) and online enrollment (as a proportion of total enrollment) over a similar time period (2010-2020), we can see that the exact proportions vary slightly from the figures above (showing undergraduate online offerings, by section, in purple), but the trends and the basic patterns remain largely the same, even if the exact percentages vary slightly (as we would expect, given the wide variability in campus data sets on course offerings).


CEHHS Undergraduate (proportions of totals)
20%
15%
10%
5%
0%
20.00%
15.00%
10.00%
5.00%
0.00%
2010-2011
2011-2012
2012-2013
2013-2014
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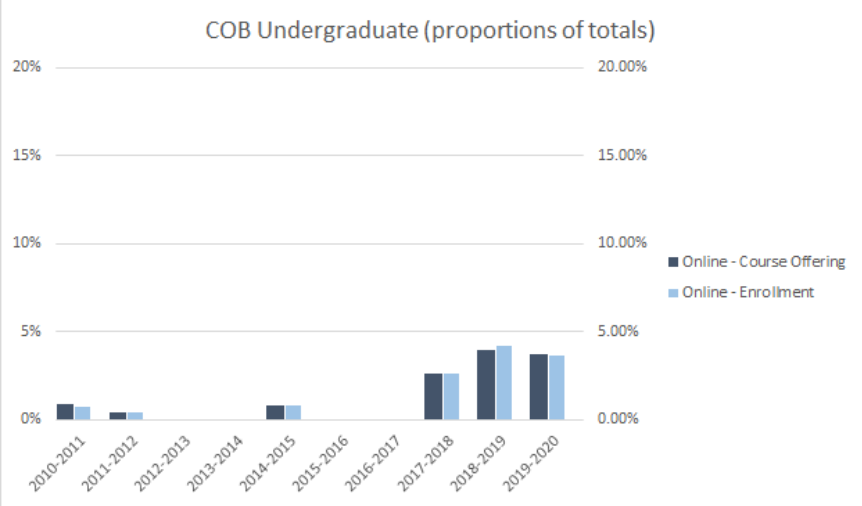
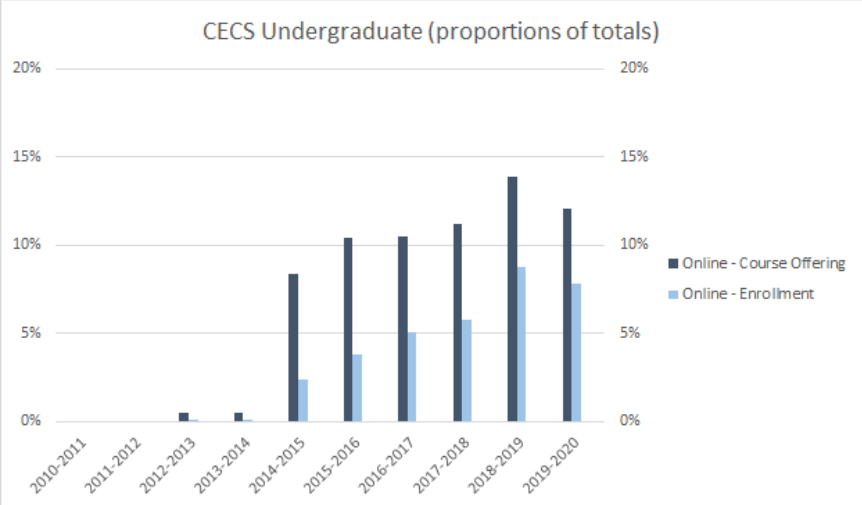
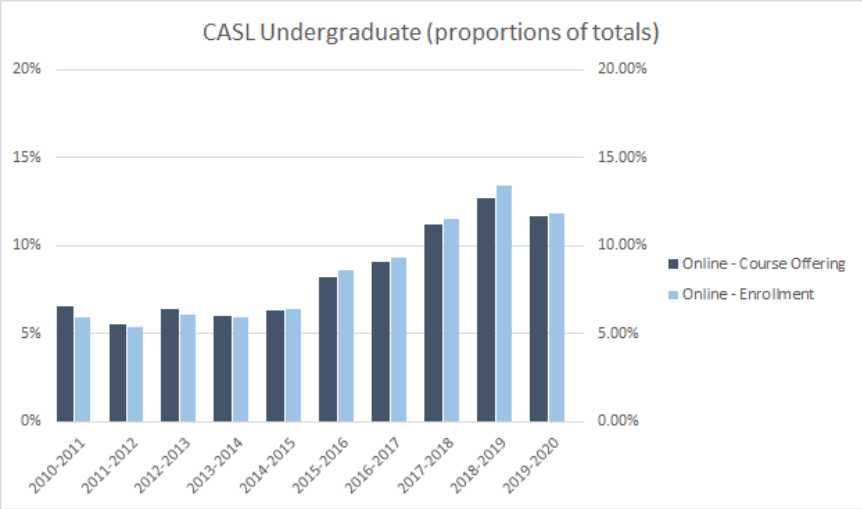
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
Online - Course Offering
Online - Enrollment

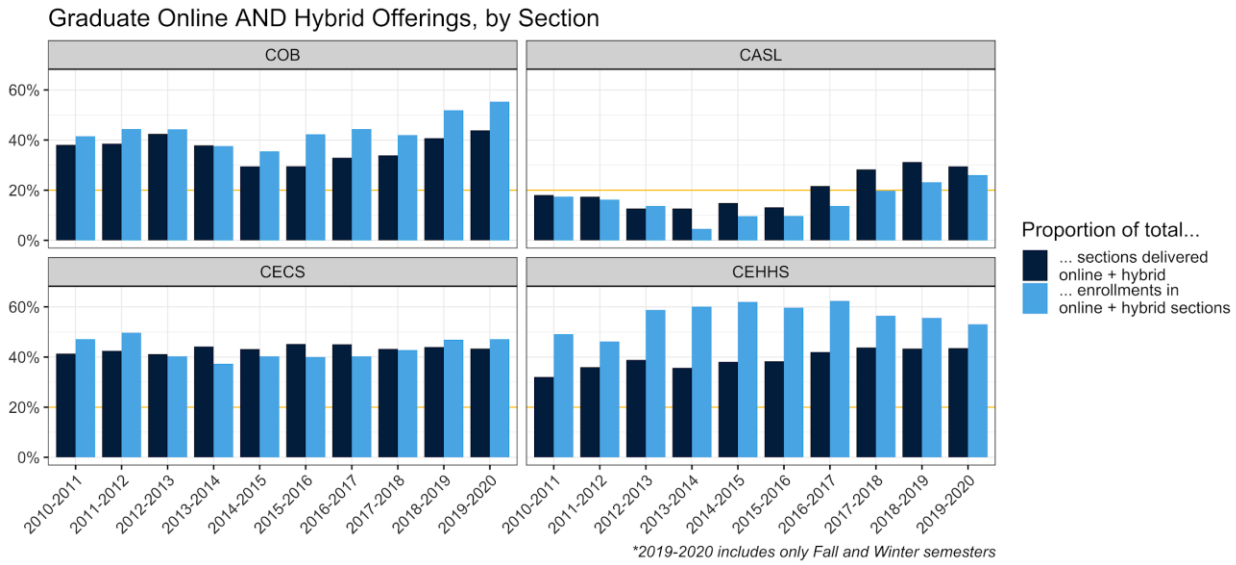

COB Undergraduate (proportions of totals)
20%
15%
10%
5%
0%
20.00%
15.00%
10.00%
5.00%
0.00%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
Online - Course Offering
Online - Enrollment

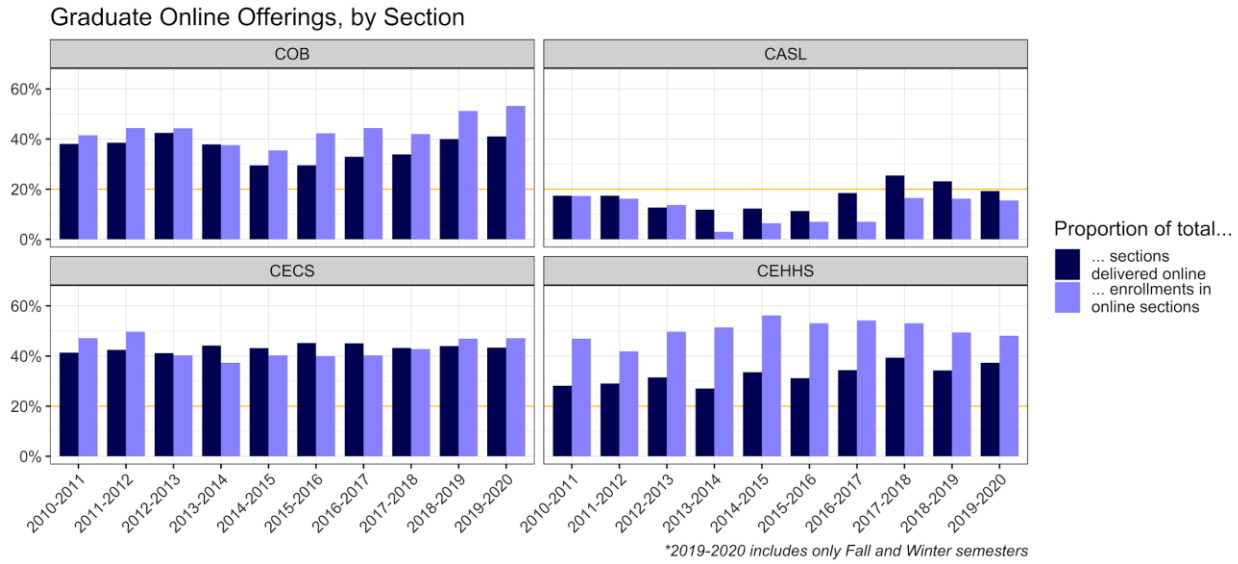

CECS Undergraduate (proportions of totals)
20%
15%
10%
5%
0%
20%
15%
10%
5%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
Online - Course Offering
Online - Enrollment

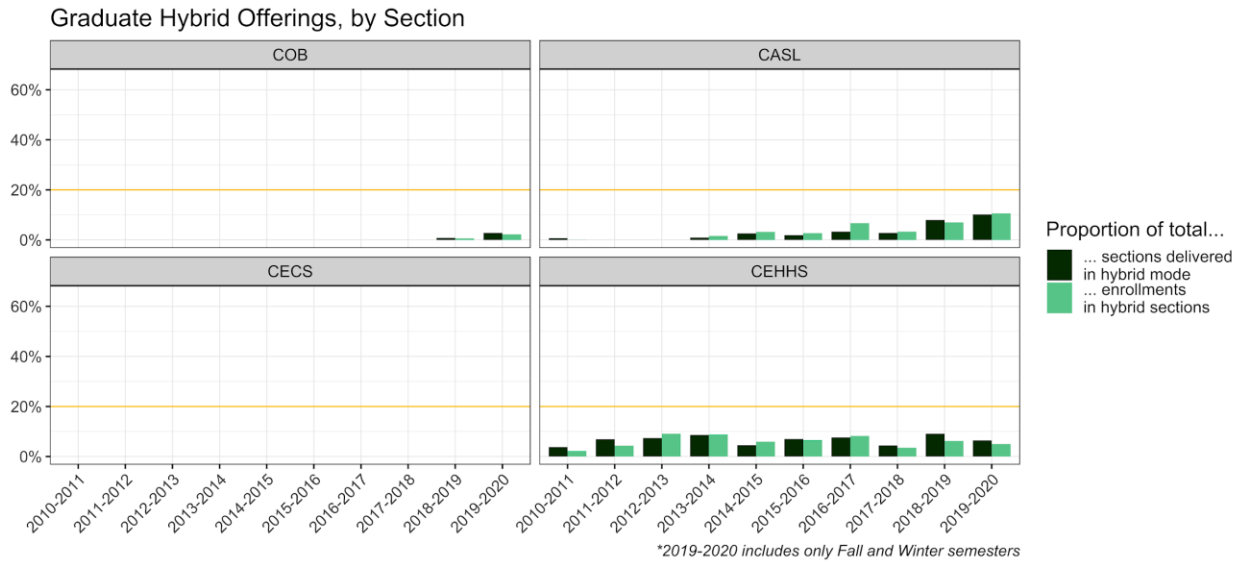


3.3 Graduate Offerings and Enrollment, by Section

The following figures show trends over time in *graduate* offerings and enrollments for online and hybrid courses, both combined and separately. **Please note the yellow horizontal line at 20%** marking the 2017 Digital Education Strategic Goal for online & hybrid course offerings.







Graduate online + hybrid offerings have been strong and steady for the past decade in COB, CECS, and CEHHS, with CASL increasing its graduate online + hybrid offerings in recent years. All colleges have surpassed 20% in both course offerings and student enrollments. The vast majority of these courses have been fully online, however, CEHHS shows a steady use of hybrid courses and CASL shows an increasing use of hybrid courses over the decade.

4 Trends in Demand for Online vs. In-Person Courses, Fall 2010 - Winter 2022

One of the ongoing strategic discussions surrounding course modalities is whether students actually want online (or hybrid) courses, and a newer question is whether student demands have shifted with the new online & remote learning experiences during the pandemic.

4.1 Fill Rates Trends for Online + Hybrid vs In-Person Undergraduate Courses

One approach to investigating student demand is to compare course fill rates. The fill rate is the proportion of seats filled relative to the total seats available. This is a useful measure to understand relative demand across modalities, as it normalizes across courses with different course caps. Given that course caps have often been set differently for online courses vs. in-person courses, the fill rate lets us see how much "slack" there is in the demand across modalities.

The original campus data — organized by sections — is not well structured to easily and accurately measure fill rates. For cross-listed courses, each section is given the course capacity of the entire course. This means that a course capped at 40, cross-listed between two subjects, could be full with 40 students, but show 20 students in each section (so that each *section* has an effective fill rate of 50%, even if the course itself has a fill rate of 100%). To deal with this structural problem in the data, the figures shown here aggregate sections by the title of the course, the section number, the instructor name, and the course capacity. This approach makes it most likely that *courses* are appropriately captured (i.e. it pulls together cross-listed versions of the same course that are all taught as one class, while keeping apart different sections of bigger courses that are taught as separate classes).

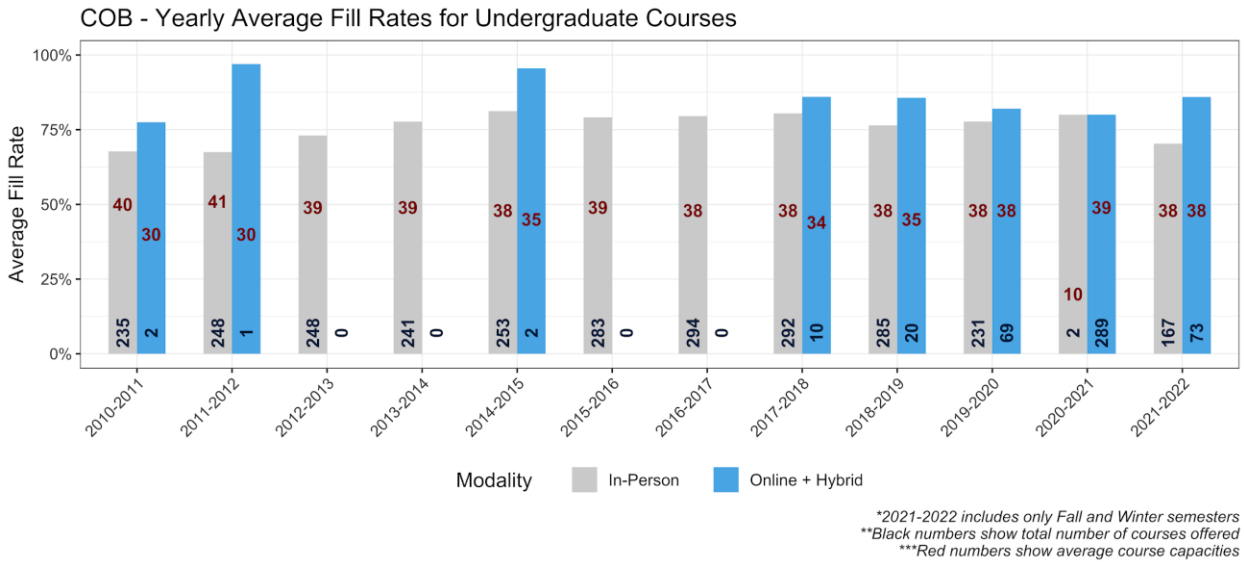
This approach does <u>not</u> capture, however, correct fill rates for courses that are cross-listed across colleges or for courses that are cross-listed across levels (i.e. courses that include both graduate and undergraduate sections). This indicates that fill rates may be systematically lower where there are many cross-listed courses that fit these criteria.

Note that there were 18 (out of 26,581) courses in the undergraduate data that were listed with capacity of 0; these 18 were excluded from this analysis.

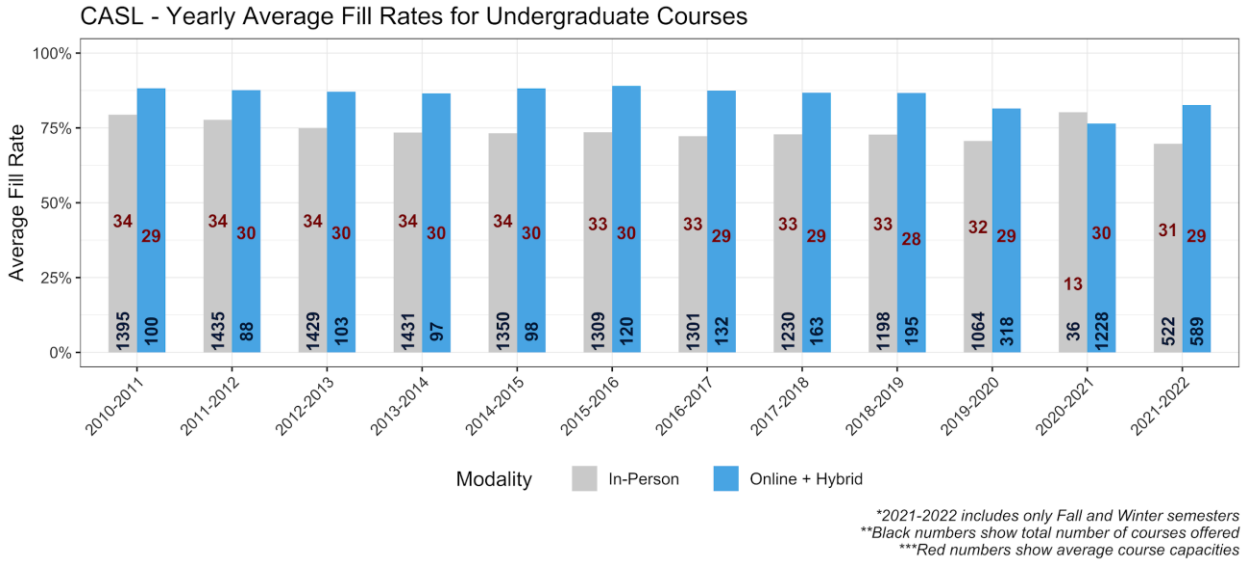
The following visualizations show, first, the average fill rates by *year* for each college, and then second, the average fill rates by *term* for each college. Note that for each figure, the total number of courses offered in each modality is at the bottom of each bar, in **black**, so that you can have a clear sense of the denominator for the mean fill rates (i.e. you might expect fill rates to look different if only 5 classes were offered in one modality while 200 were offered in the other modality).

The yearly fill rate figures also include a number in **dark red**, which shows the average course capacities by modality and year. These numbers vary in their locations on the bars, with higher average course capacities appearing higher on the bars, and lower average course capacities appearing lower on the bars. Given that fill rates are quite variable across campus, and that online courses have often had lower course capacities than in-person classes, the average course capacity provides additional and important context for the yearly fill rates.

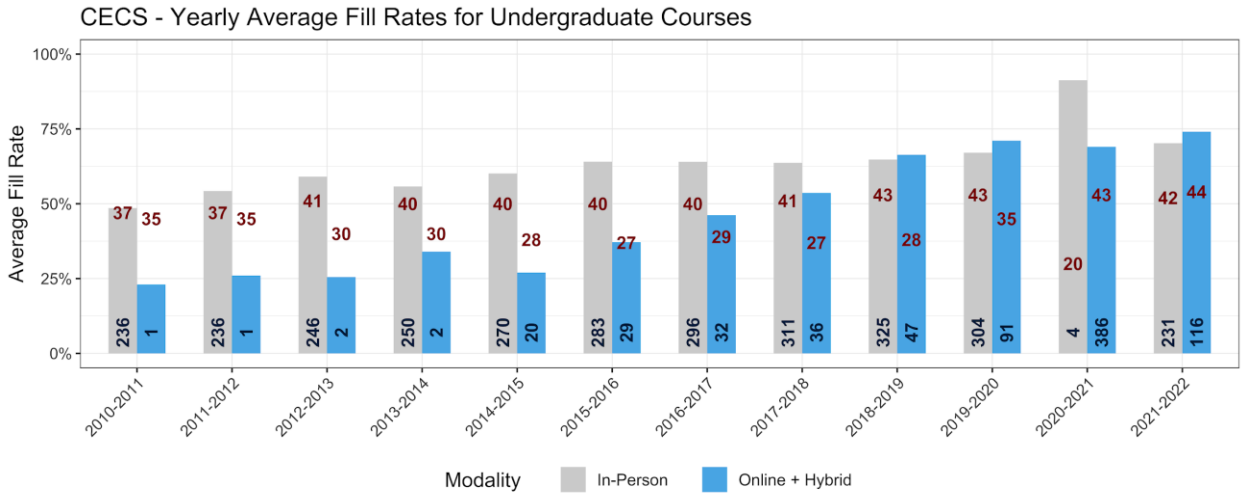
4.2 Yearly Average Fill Rates for Undergraduate Courses

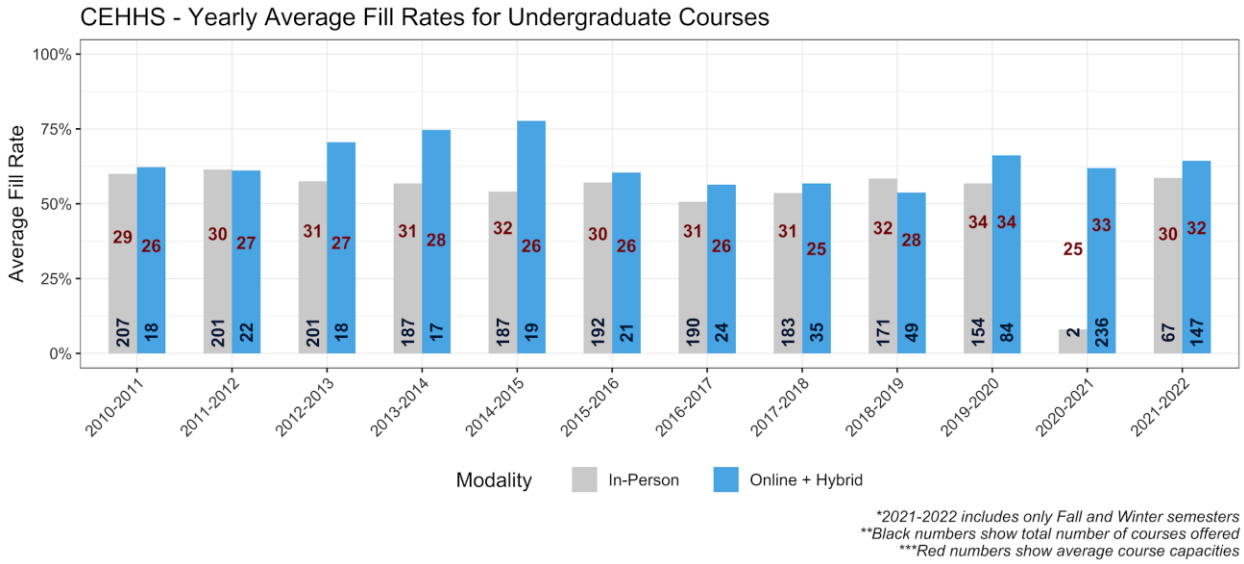


*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities





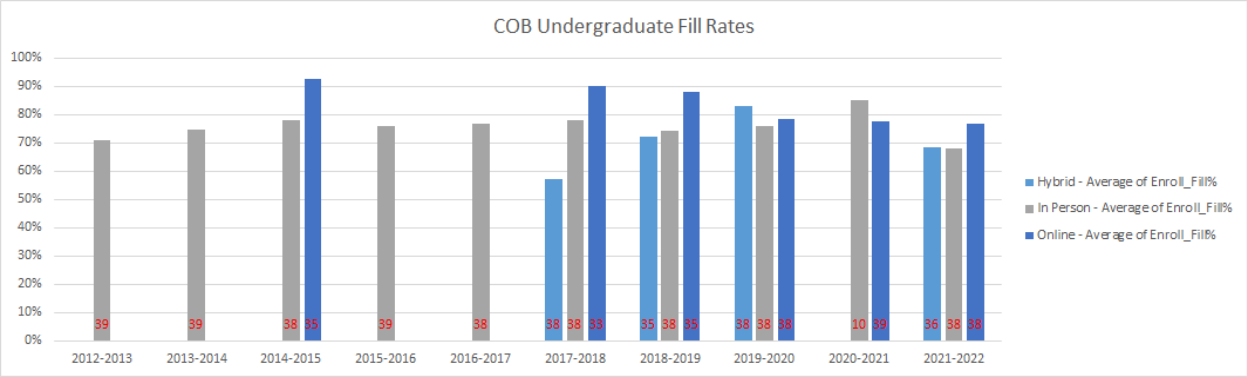
For CASL, COB, and CEHHS, the average fill rates are almost uniformly higher for online/hybrid courses than for in-person courses across the entire time period. For CECS, the beginning of the time period shows the opposite — in person courses had much higher fill rates than online courses — but over time that changed dramatically, with online/hybrid courses strengthening their fill rates relative to in-person courses, and overtaking in-person fill rates in 2018-2019, before the pandemic. The only reversal in these trends for most of the colleges was in 2020-2021, at the height of the pandemic, when very few courses were offered in person.

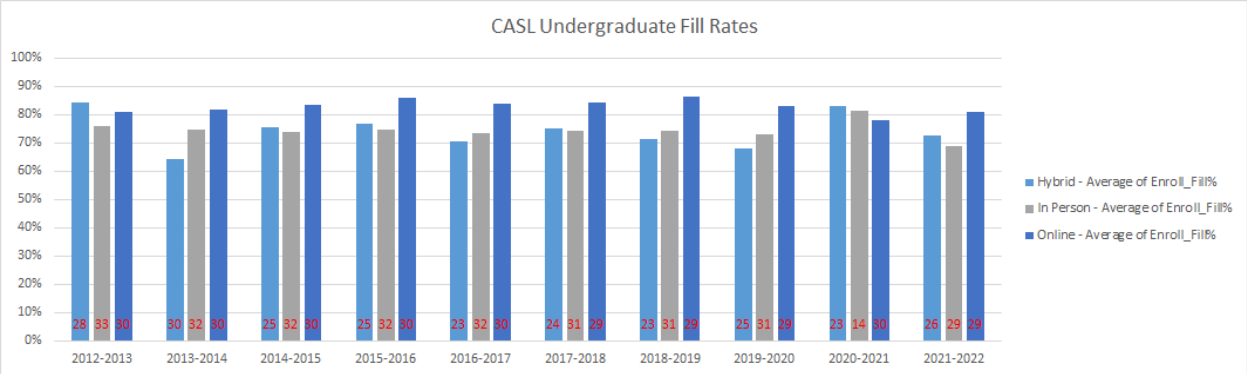
This data shows very clearly that there is strong demand for online/hybrid courses relative to in-person courses for all four colleges. As 2020-2021 shows, there is clearly a threshold where that demand would reverse, but we are not reaching that equalizing threshold in any of the colleges, currently (even with the relative increase in online/hybrid courses seen in 2021-2022).

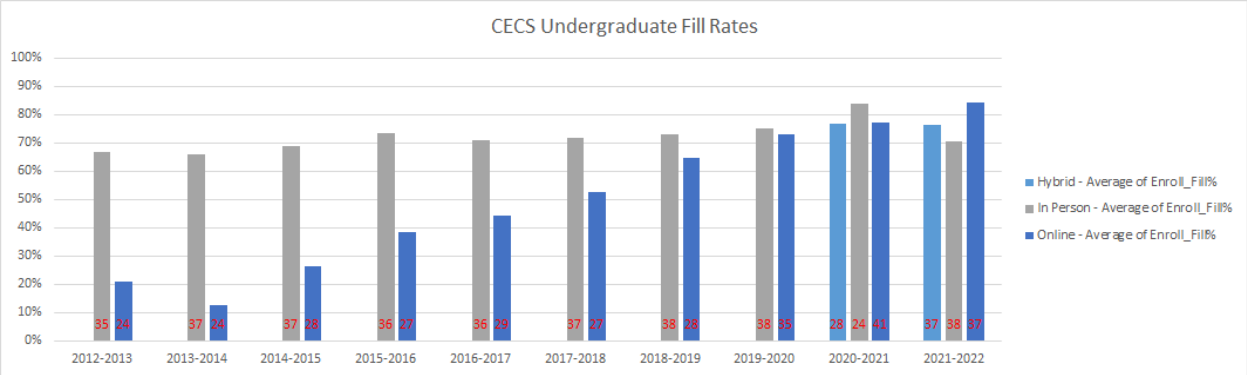
4.2.1 Undergraduate Fill Rate Trends, Using a Different Data Set

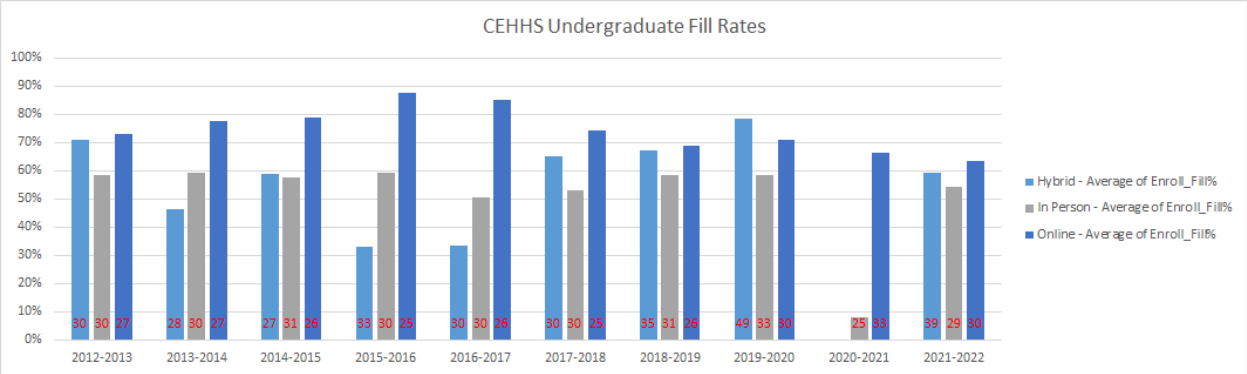
As in Section 3.2.1, it is worth acknowledging that different campus data may provide a different view on the question. Using the same data described in Section 3.2.1, the following shows a similar fill rate analysis, though here online and hybrid courses are shown separately. This data is different from the above, in that crosslisted CRNs are viewed as a single course, even including graduate CRNs that may be crosslisted with undergraduate. This may give a more accurate fill rate percentage, as all crosslisted CRNs are also considered for the course caps.

While the data is different, and the online & hybrid categories are separated, the same trends hold as in Section 4.2: hybrid and online courses generally fill as well or better than in person courses for COB, CEHHS, and CASL throughout the time frame, and CECS shows the same pattern in recent years.





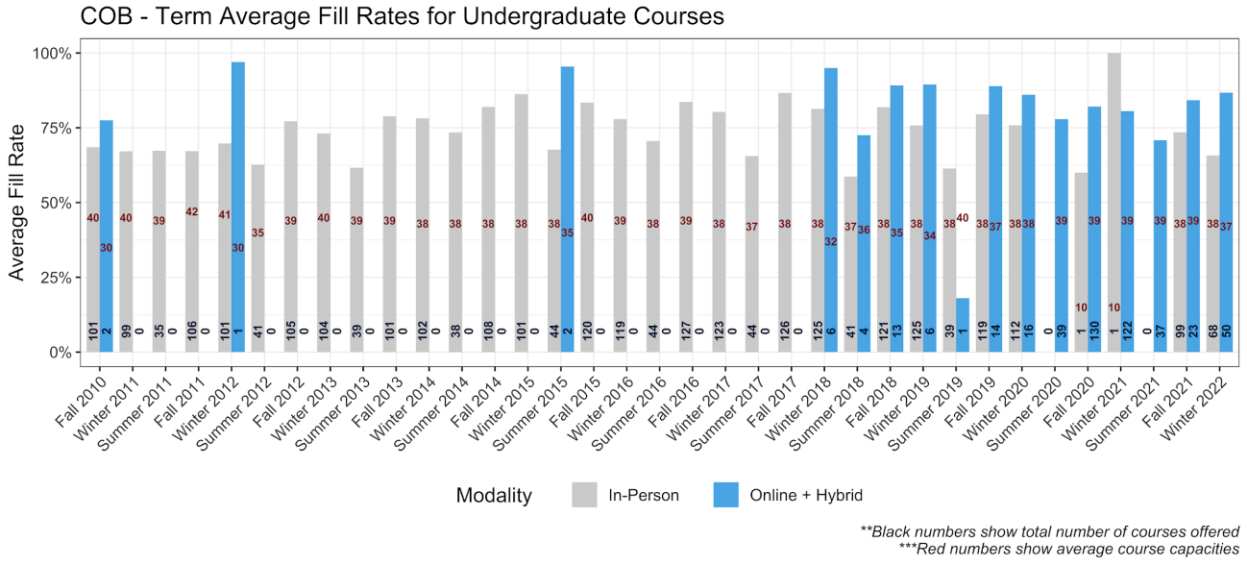




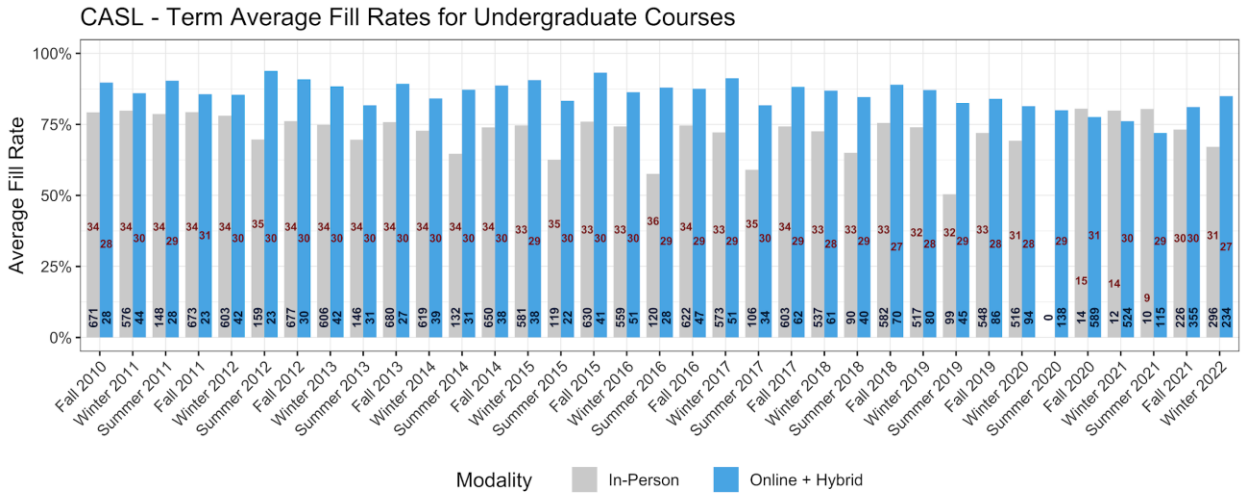
4.3 Term Average Fill Rates for Undergraduate Courses

It is also instructive to look at this same data aggregated by term, rather than by year. In these visualizations, it is possible to see some differences between Summer terms and Fall/Winter terms, over time, which have often had different proportions of in-person and online/hybrid offerings.

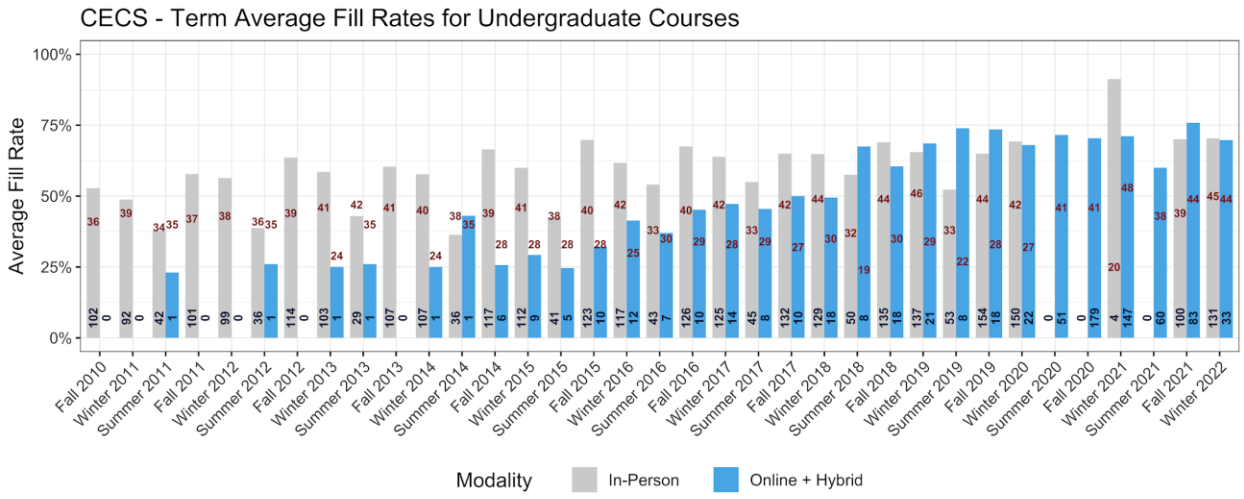
The total number of courses offered in each modality in each term is again included, in tiny black text, at the bottom of each bar. The average course capacity is shown in tiny red text within each bar. Given the density of data on these term-level visualizations, you will likely need to zoom in to be able to read the details.



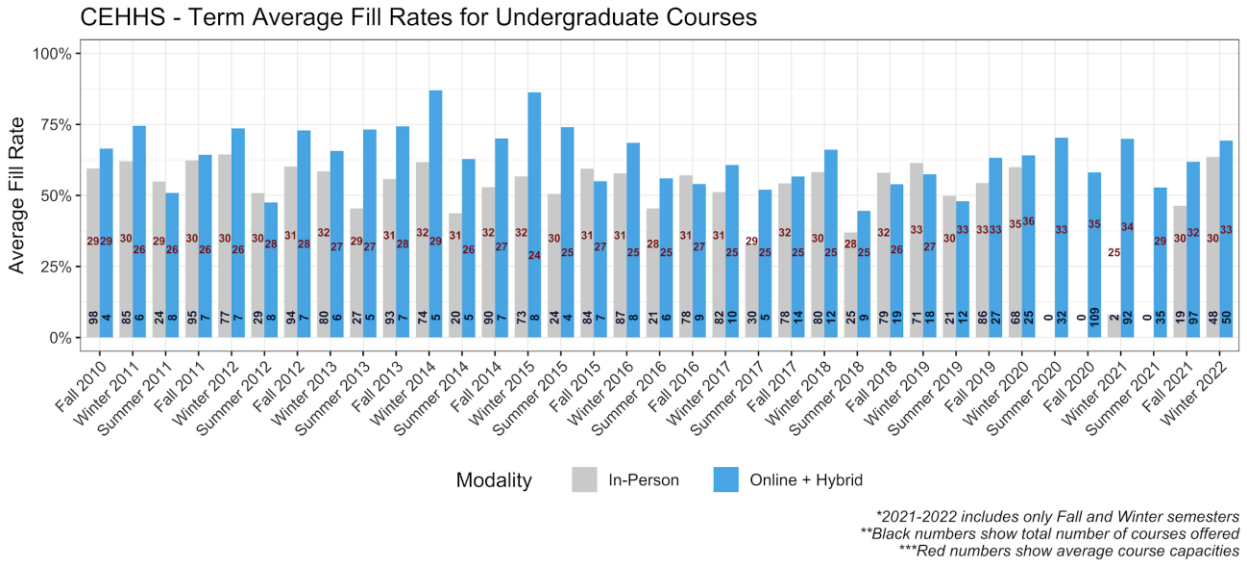
***Black numbers show total number of courses offered*
****Red numbers show average course capacities*



*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities

Disaggregated by term, there is a bit more variation across average fill rates. But in general, the same trend holds: online/hybrid courses show higher average fill rates than in-person courses. Only when very low numbers of in-person courses were offered during the pandemic did this pattern reverse (even though, on average, in-person courses had a much lower average course capacity at the same time!).

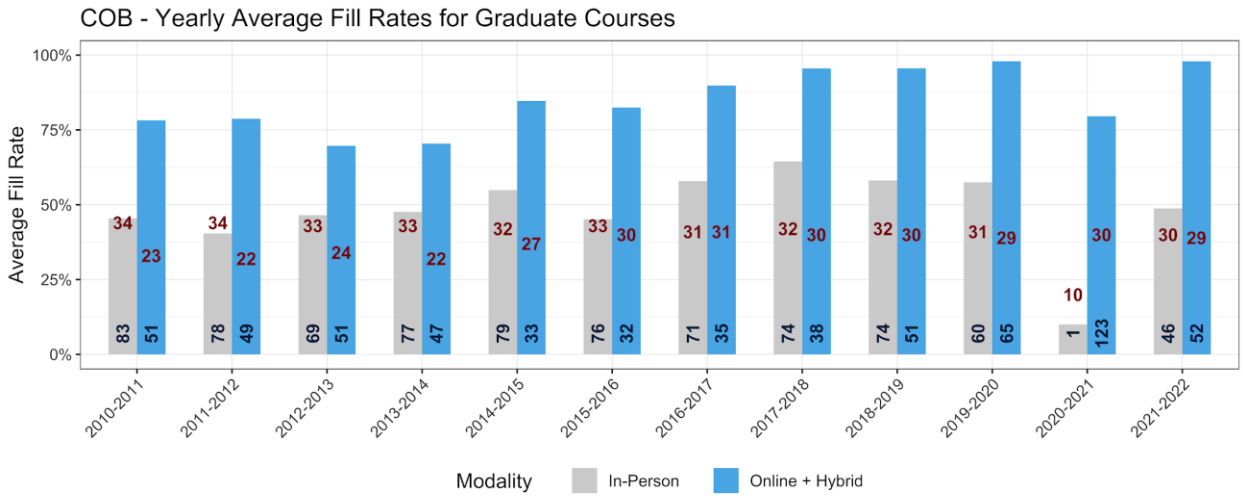
4.4 Yearly Average Fill Rates for Graduate Courses

We can follow the same approach to investigate fill rates in graduate-level courses (though please note the limitation, mentioned above, that these figures do not accurately capture fill rates for courses cross-listed across colleges or across levels).

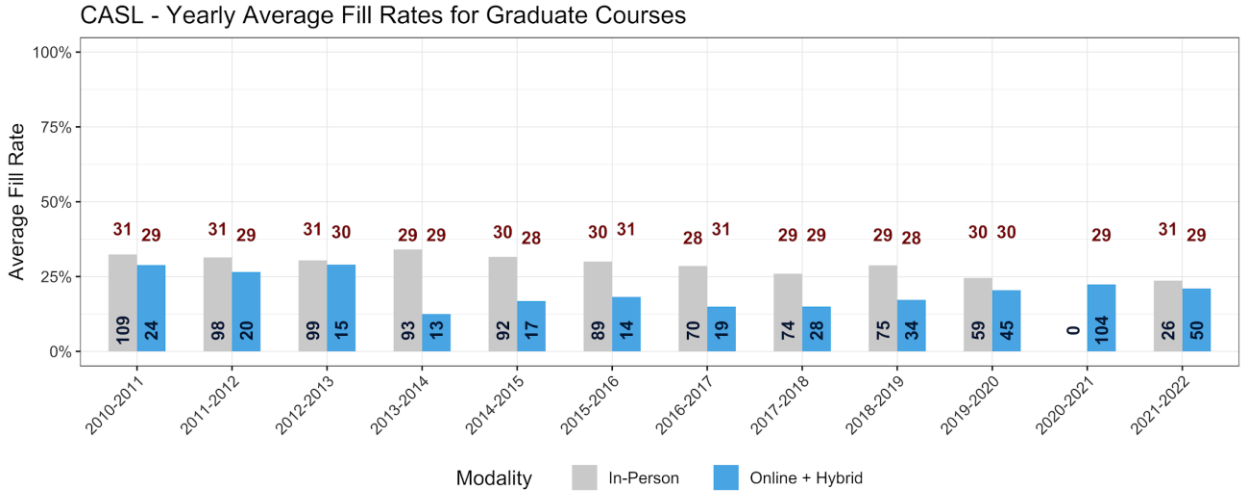
These visualizations show the average fill rates by year for each college. Note that, as above, for each figure, the total number of courses offered in each modality is at the bottom of each bar, in **black**, so that you can have a clear sense of the denominator for the mean fill rates (i.e. you might expect fill rates to look different if only 5 classes were offered in one modality while 200 were offered in the other modality). The yearly fill rate figures also include a number in **dark red**, which shows the average course capacities by modality and year. Given that fill rates are quite variable across campus, and that online courses have often had lower course capacities than in-person classes, the average course capacity provides additional context for the yearly fill rates. Note that there were 8 (out of 7,854) courses in the data that were listed with capacity of 0; these 8 were excluded from this analysis.

The patterns of modality fill rates for graduate courses vary much more across colleges here than was the case for undergraduate fill rates. Both COB and CEHHS show much higher average fill rates for online/hybrid than for in-person classes (at least up to the pandemic). CECS started out the decade with higher fill rates for in person courses, but that pattern has reversed since 2017 as the fill rates for online courses have continued to increase. CASL stands

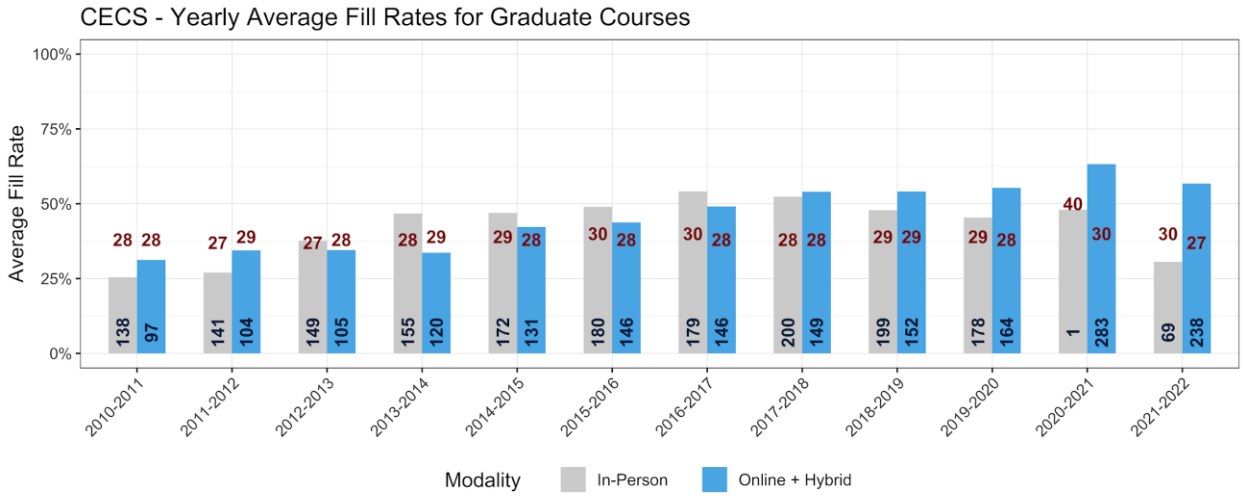
out with a consistent pattern of higher fill rates for in-person graduate courses compared to online/hybrid courses.

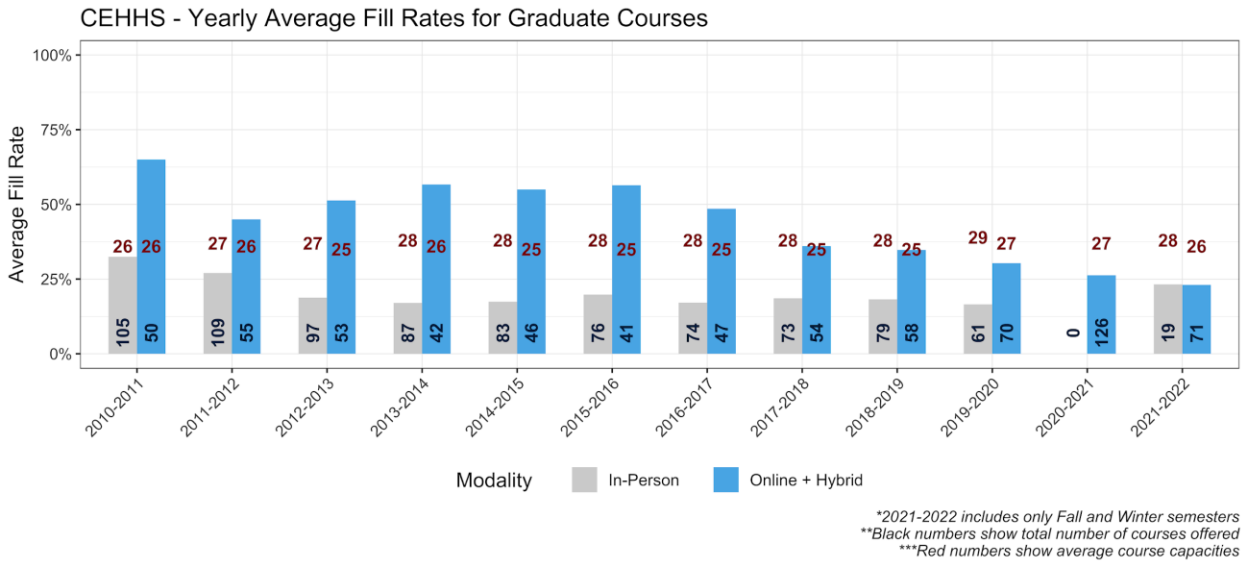


*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters
**Black numbers show total number of courses offered
***Red numbers show average course capacities

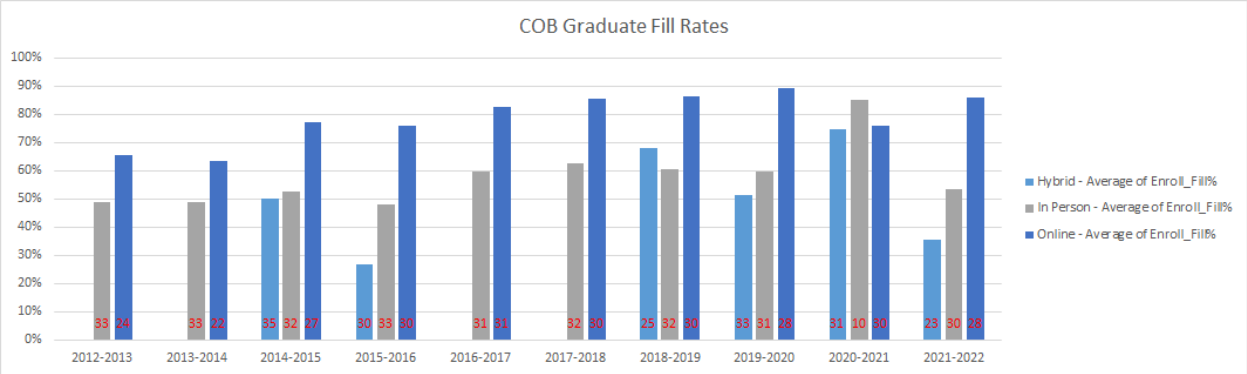


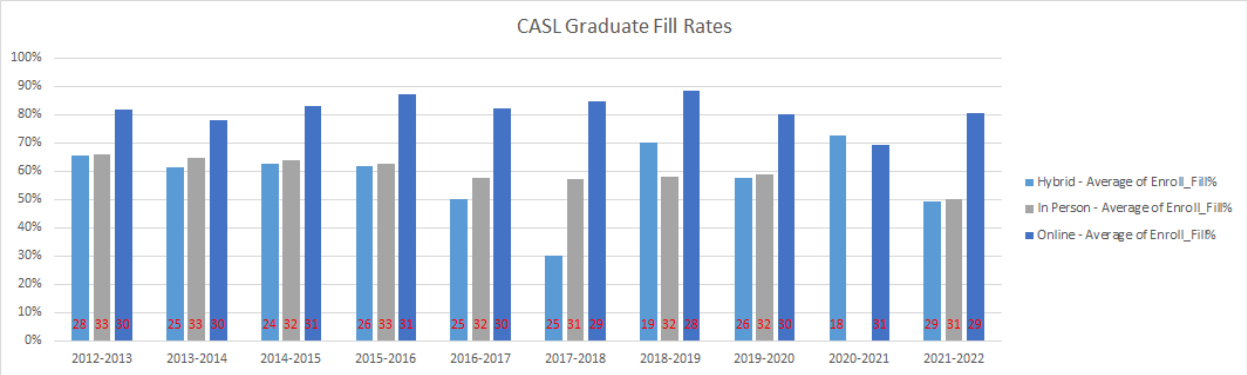


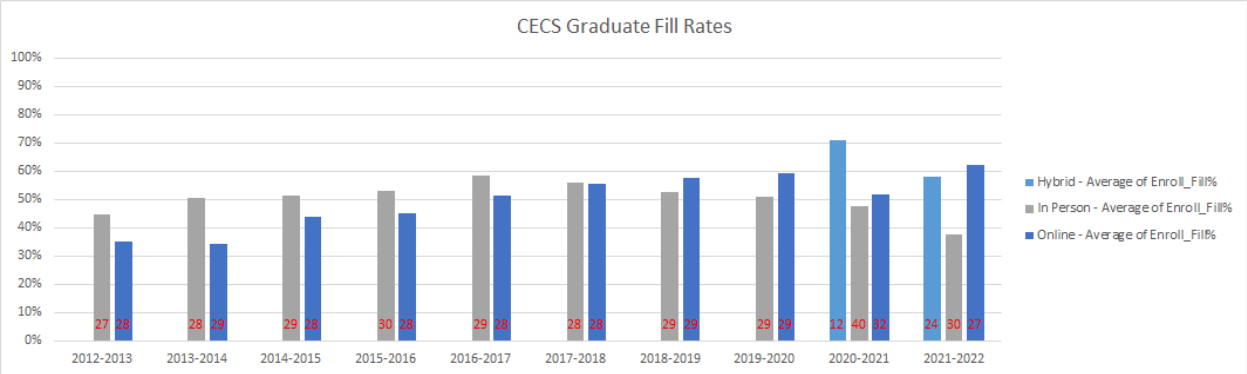
4.4.1 Graduate Fill Rate Trends, Using a Different Data Set

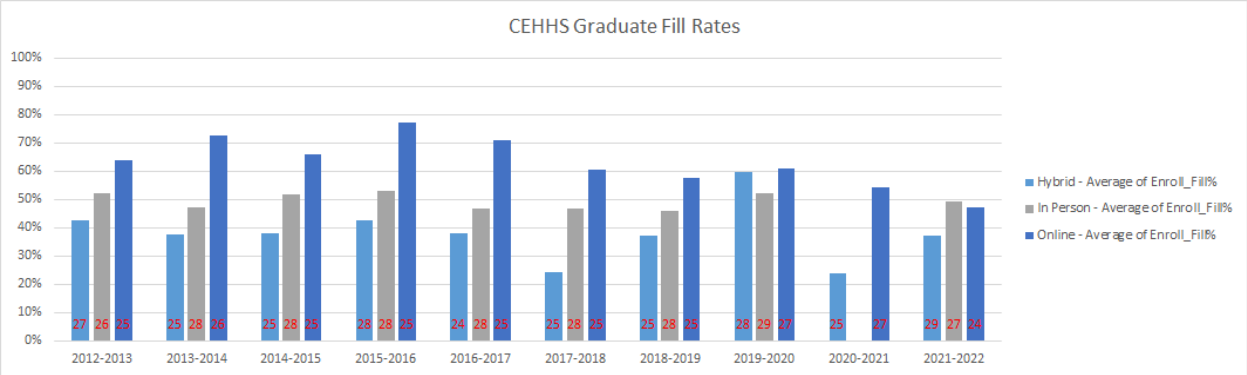
As in Section 4.2.1, we can see the trends for Graduate fill rates using a different data set. Here, fill rates for online and hybrid courses are separated out.

This data again shows that for graduate students, online courses tend to have the highest fill rates, with hybrid courses tending to slightly underperform in person courses. The main difference between these figures, and those in Section 4.4 is that CASL shows a much stronger fill rate for online and hybrid courses, largely due to CASL's higher tendency to cross-list across levels and programs. When viewing individual CRNs, that can cause fill rates to look low, but combining all crosslisted CRNs together provides a more accurate picture of the fill rate.


COB Graduate Fill Rates
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
33 24
33 22
35 32 27
30 33 30
31 31
32 30
25 32 30
33 31 28
31 10 30
23 30 28
Hybrid - Average of Enroll_Fill%
In Person - Average of Enroll_Fill%
Online - Average of Enroll_Fill%


CASL Graduate Fill Rates
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
28 33 30
25 33 30
24 32 31
26 33 31
25 32 30
25 31 29
19 32 28
26 32 30
18 31
29 31 29
Hybrid - Average of Enroll_Fill%
In Person - Average of Enroll_Fill%
Online - Average of Enroll_Fill%


CECS Graduate Fill Rates
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
27 28
28 29
29 28
30 28
29 28
28 28
29 29
29 29
12 40 32
24 30 27
Hybrid - Average of Enroll_Fill%
In Person - Average of Enroll_Fill%
Online - Average of Enroll_Fill%


CEHHS Graduate Fill Rates
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
27 26 25
25 28 26
25 28 25
28 28 25
24 28 25
25 28 25
25 28 25
28 29 27
25 27
29 27 24
Hybrid - Average of Enroll_Fill%
In Person - Average of Enroll_Fill%
Online - Average of Enroll_Fill%

5 Demand Trends for Individual Courses Offered in Multiple Modalities

To more clearly understand student demand at a more granular level, the following analysis focuses exclusively on undergraduate courses that were offered in multiple modalities *simultaneously* in at least one semester (between Fall 2010 and Winter 2022). In other words, was there at least one semester where multiple sections of the course were offered, with at least one online and one in-person, or at least one online and one hybrid, etc.? There are 166 courses that fit this criteria: 18 from COB, 21 from CEHHS, 36 from CECS, and 94 from CASL.

By focusing in this way, we can see directly how student demand is distributed across different modalities. The underlying assumption is that this allows us to see modality demand across similarly situated students with similar curricular requirements, but perhaps different preferences or needs for those different modalities.

For transparency, here are the technical details for how the following visualizations were constructed. “Courses” were counted by course name (aggregated by semester, college, course title, course section number, instructor, and modality). This collapses cross-listed courses, but not sections, which allows for a more accurate assessment of average enrollment across separate courses in each modality. To calculate this, fill rates were calculated by course, and then aggregated by full year (to ensure that courses with similar names, section numbers, and instructors across *semesters* would still count as separate courses in the dataset).

As with previous fill rate figures, the number of courses in each modality/year are listed in black at the bottom of the fill-rate bars, while the mean course capacity for each modality/year are listed in red within each fill-rate bar (varying in placement by the magnitude of that course capacity for easier visualization). But, since these figures each include 6 to 9 courses, you will definitely need to zoom in on the figures to actually read them!

Please note that **the y-axes are NOT the same** across all of these figures. Since these graphs are showing fill rates for individual courses, there are some courses with fill rates of over 100%. This means that students were allowed to enroll over the course capacity limit for at least one of the sections offered that year. A close look (at the teeny tiny font) indicates that in several of these cases, the course capacities had been set quite low relative to the number of students allowed in.

Please also note that because the courses here are divided by three modalities (in-person, online, and hybrid), some courses showing both an online and a hybrid section in the same year may have been a single course taught by a single instructor in two modalities at the same time. In these and similar cases, the course capacities may be overstated (again, because such cross-lists usually show the full course capacity for each of the sections, even if students cannot enroll to that course cap in each separate section).

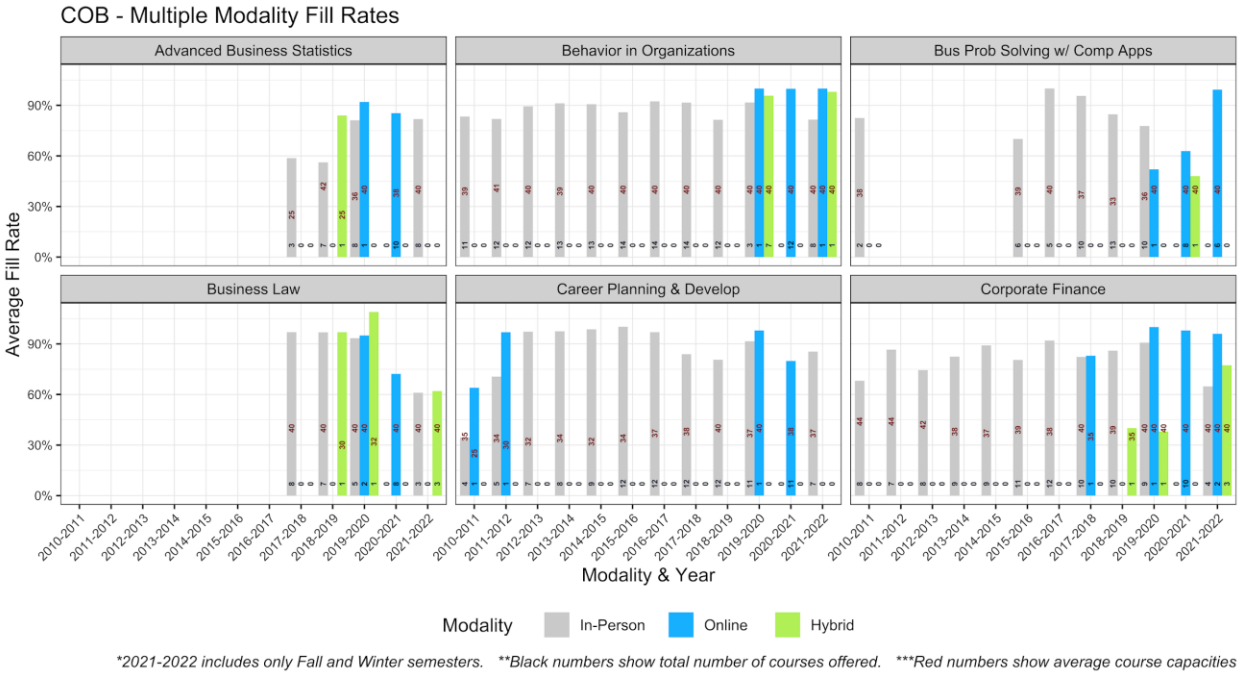
What we can see across all of these courses, taught at least once in multiple modalities during the same semester, is that there is no universal rule about fill rates and modalities. It is definitively not the case that in-person courses always fill more than online courses. And it is

clear that there is still additional demand for online versions of courses that is not yet being provided.

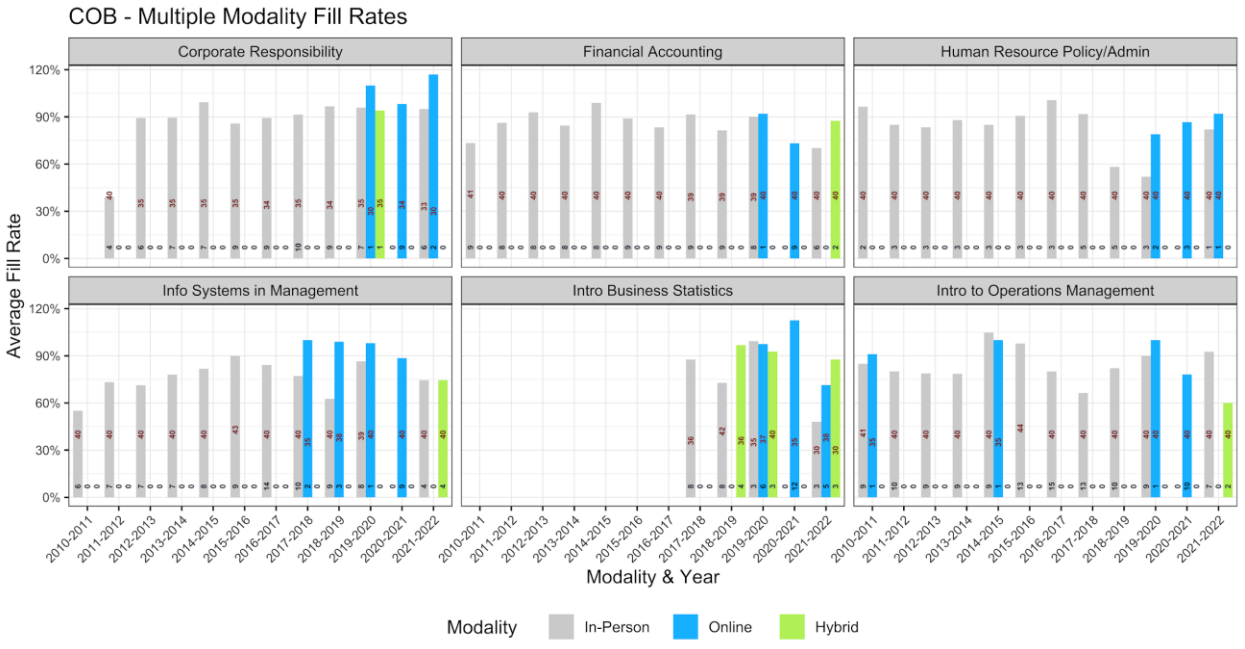
It is also worth noting that while there is anecdotal evidence on campus that students are not fond of hybrid classes, this is not at all visible in the fill rates. Recent offerings of many hybrid courses show fill rates comparable to other modalities offered at the same time.

There are a lot of figures in this section of the appendix, but the assumption is that faculty from different colleges and programs will find it most helpful to see the trends for courses they may be more familiar with.

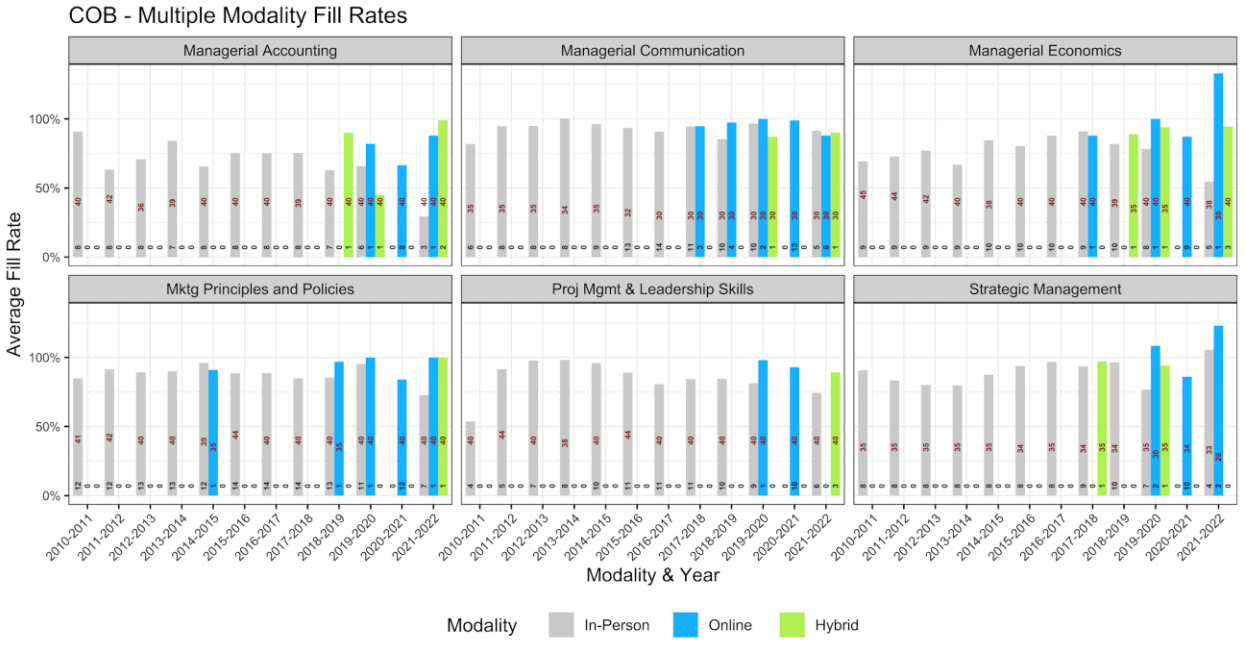
5.1 COB - Multiple Modality Fill Rate Trends



*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

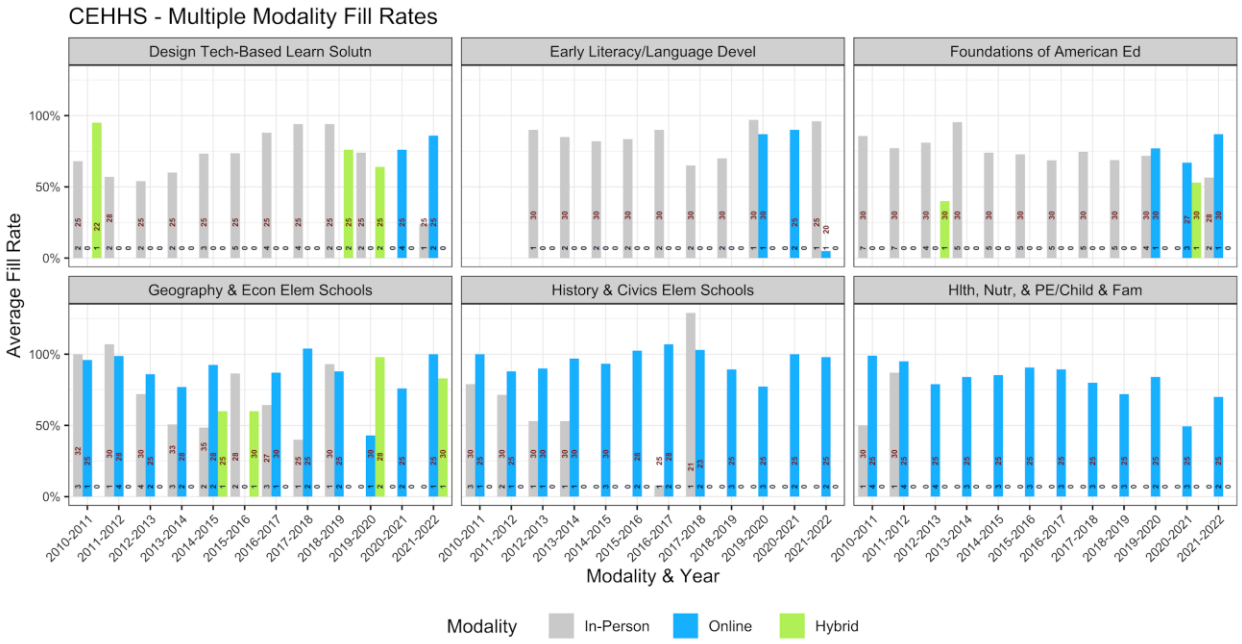


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

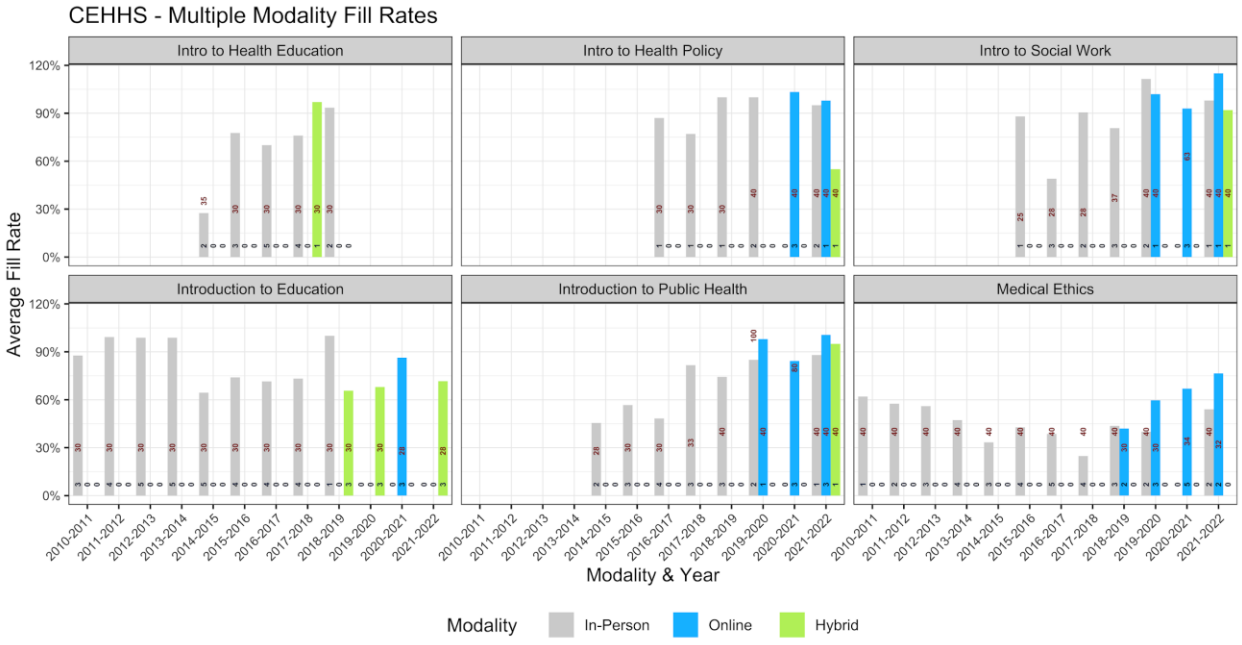


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

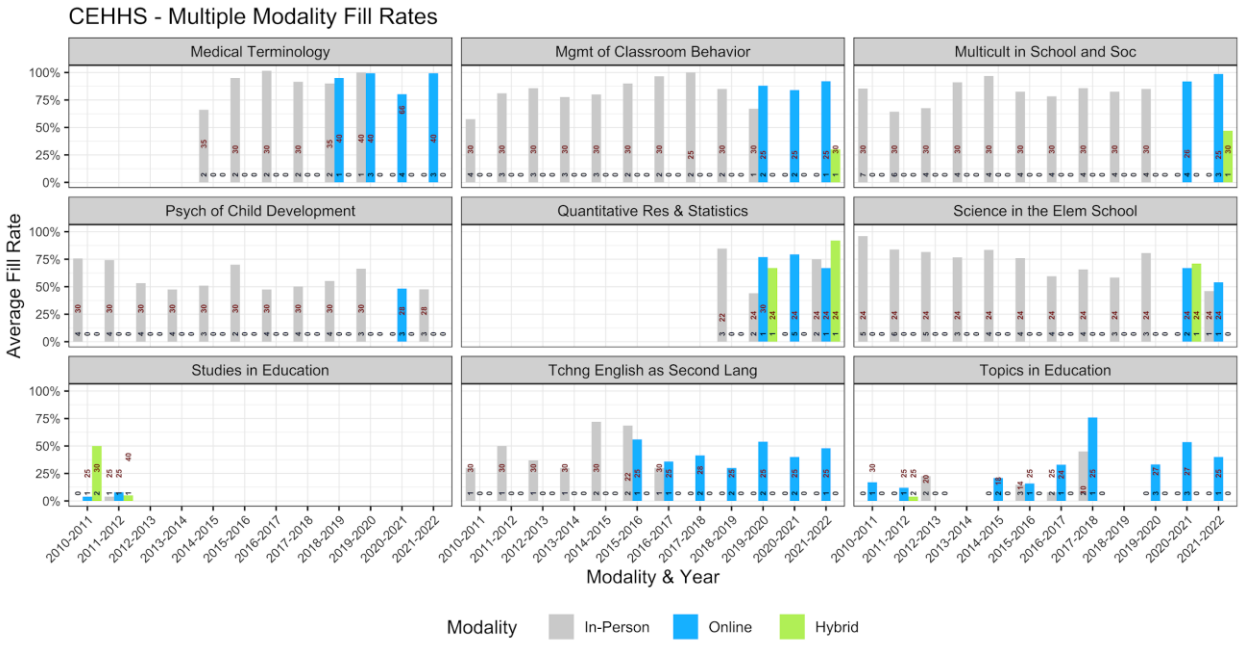
5.2 CEHHS - Multiple Modality Fill Rate Trends



*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

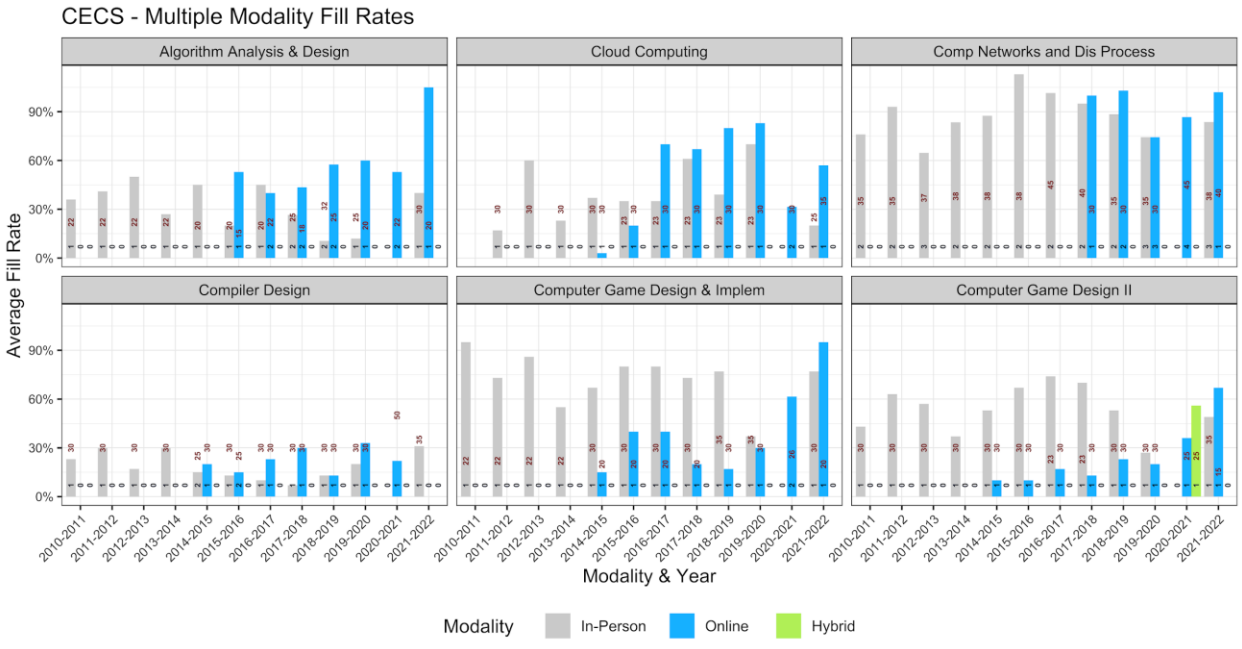


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

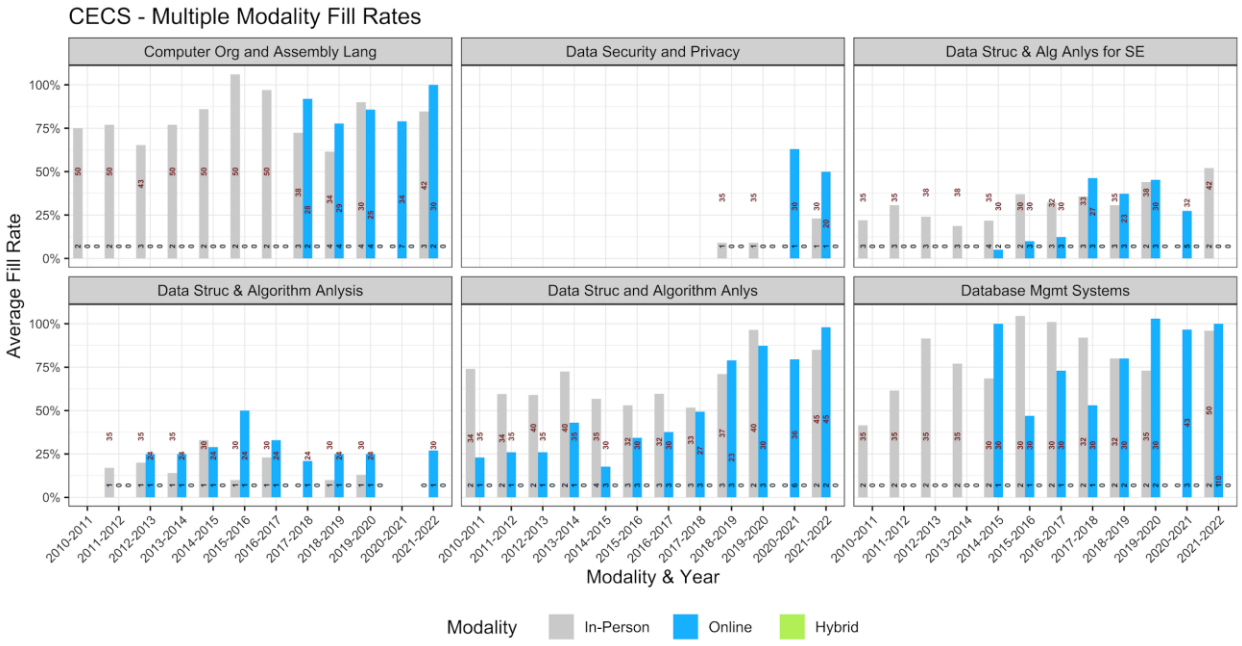


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

5.3 CECS - Multiple Modality Fill Rate Trends

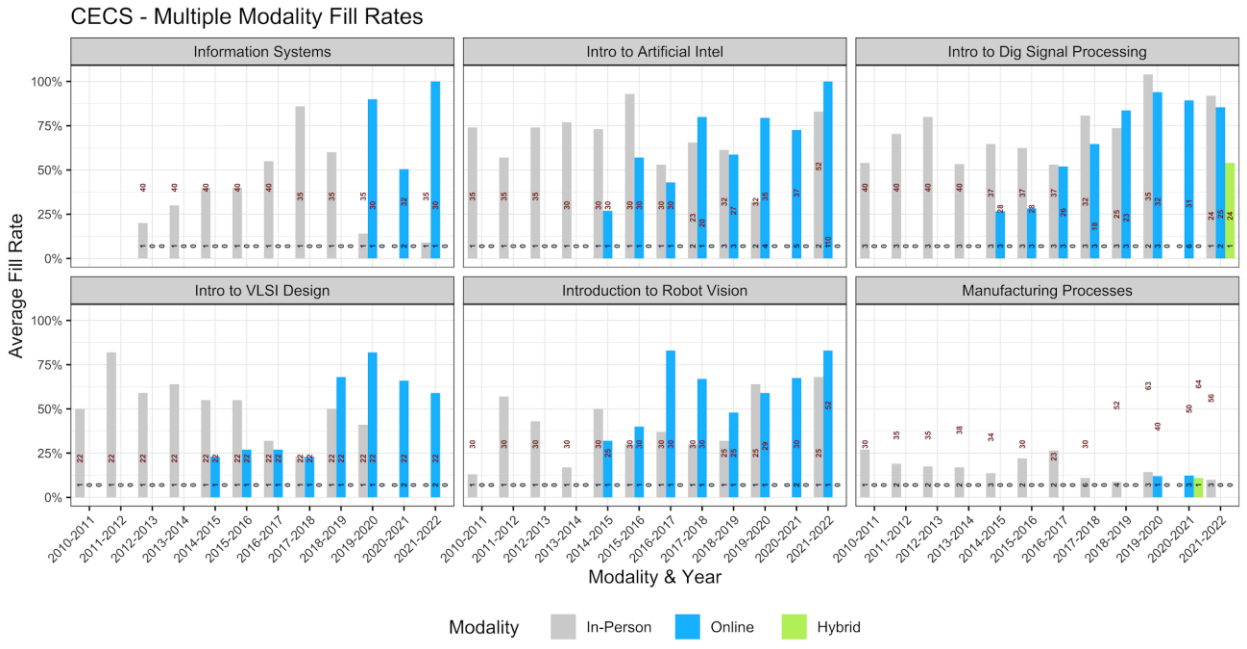


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

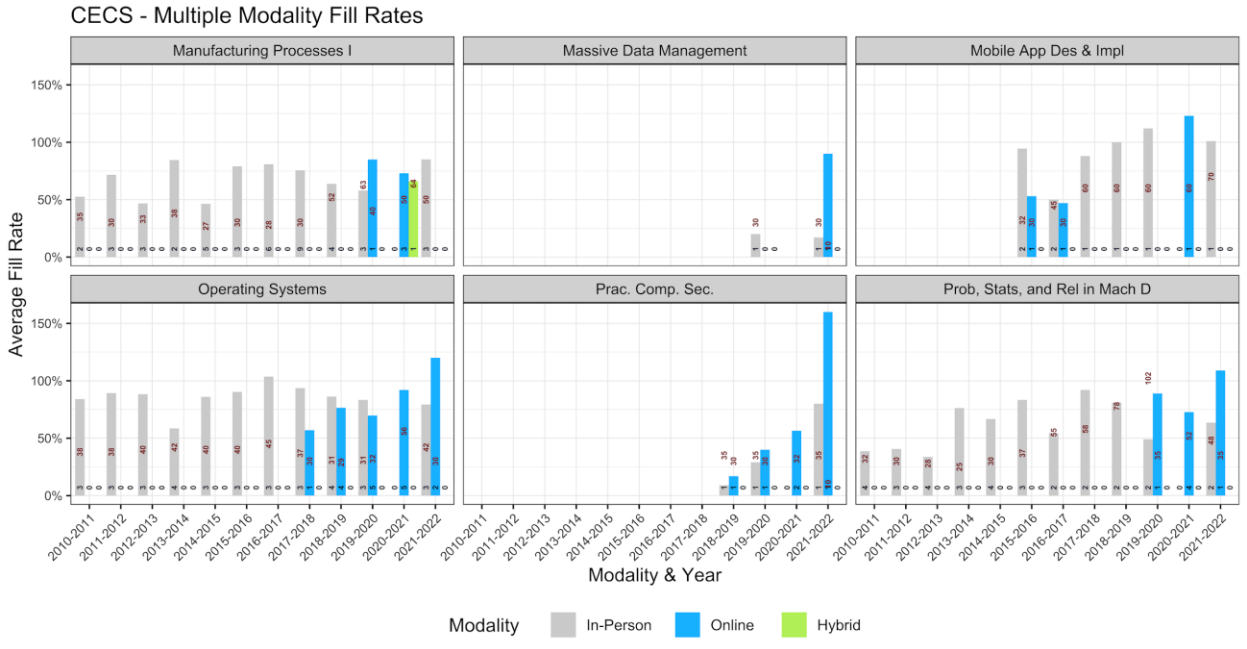


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

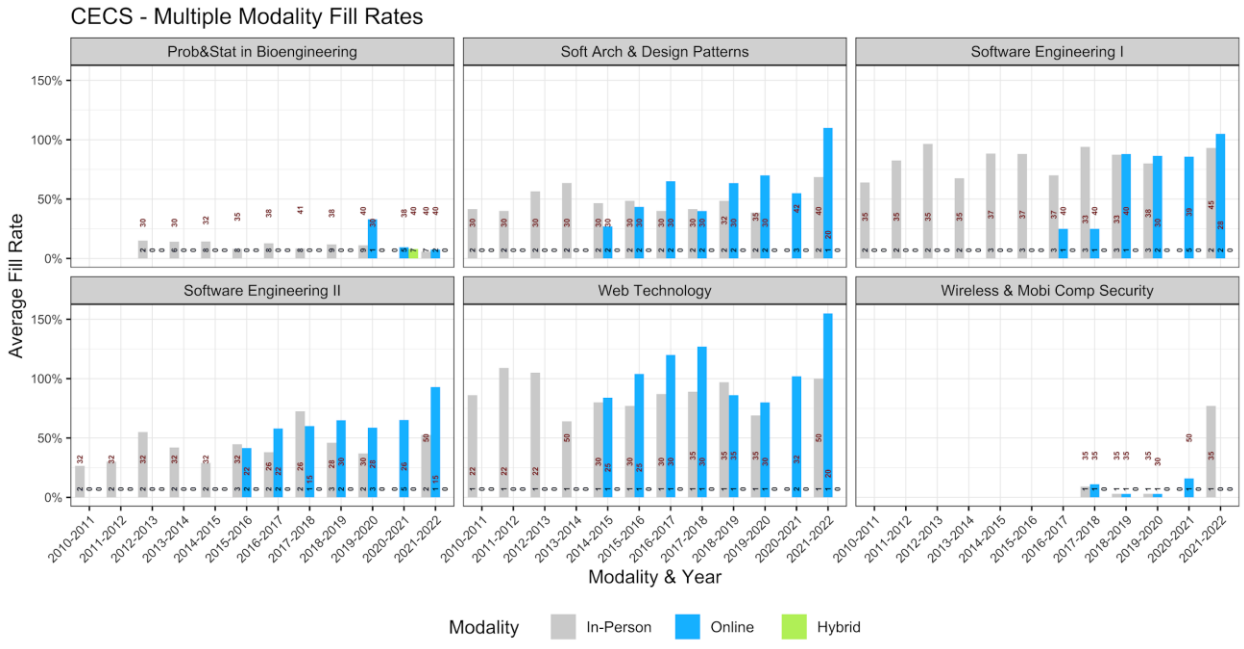
*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

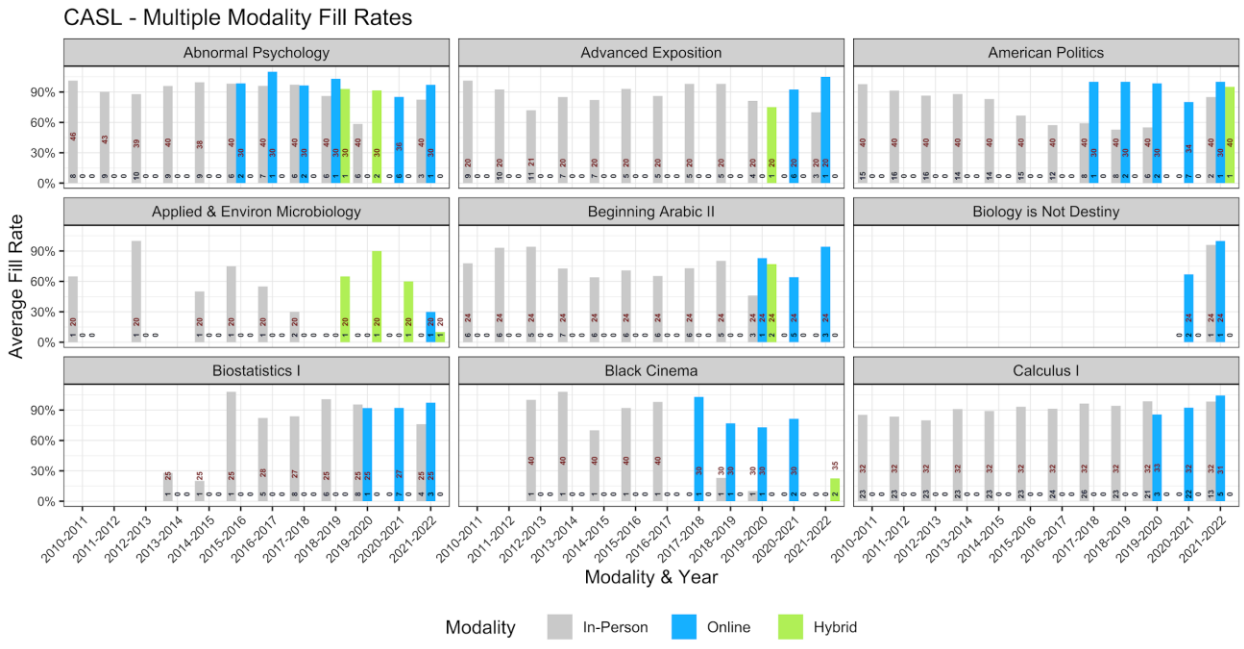


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

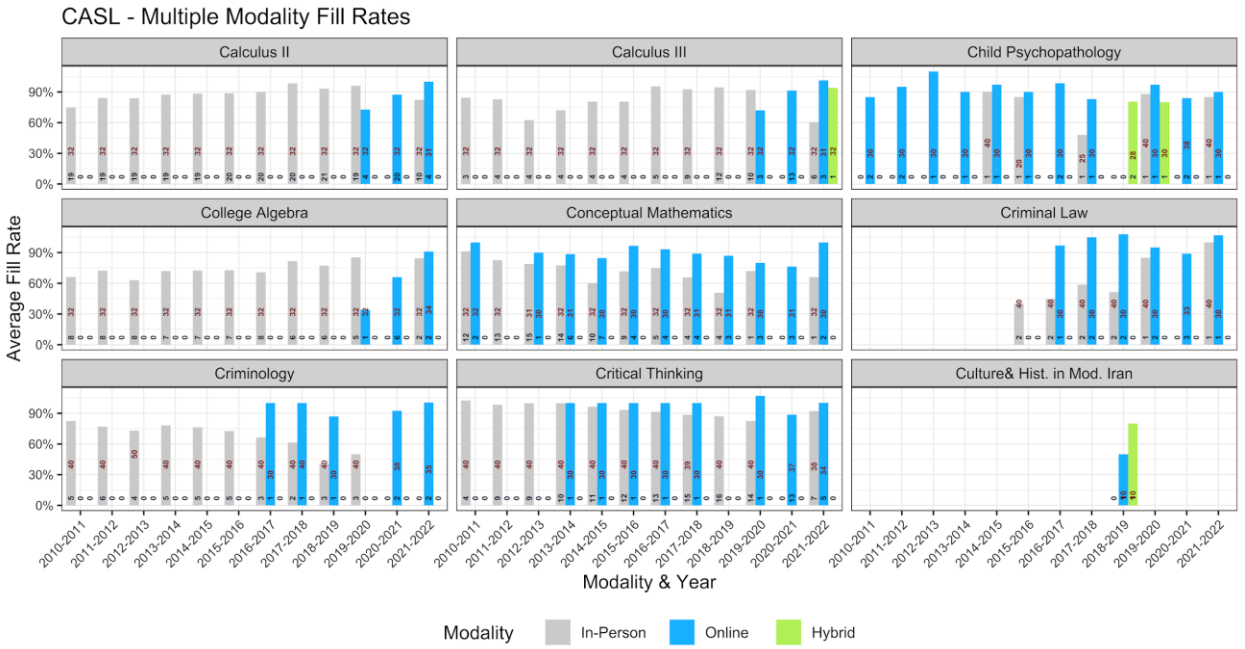


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

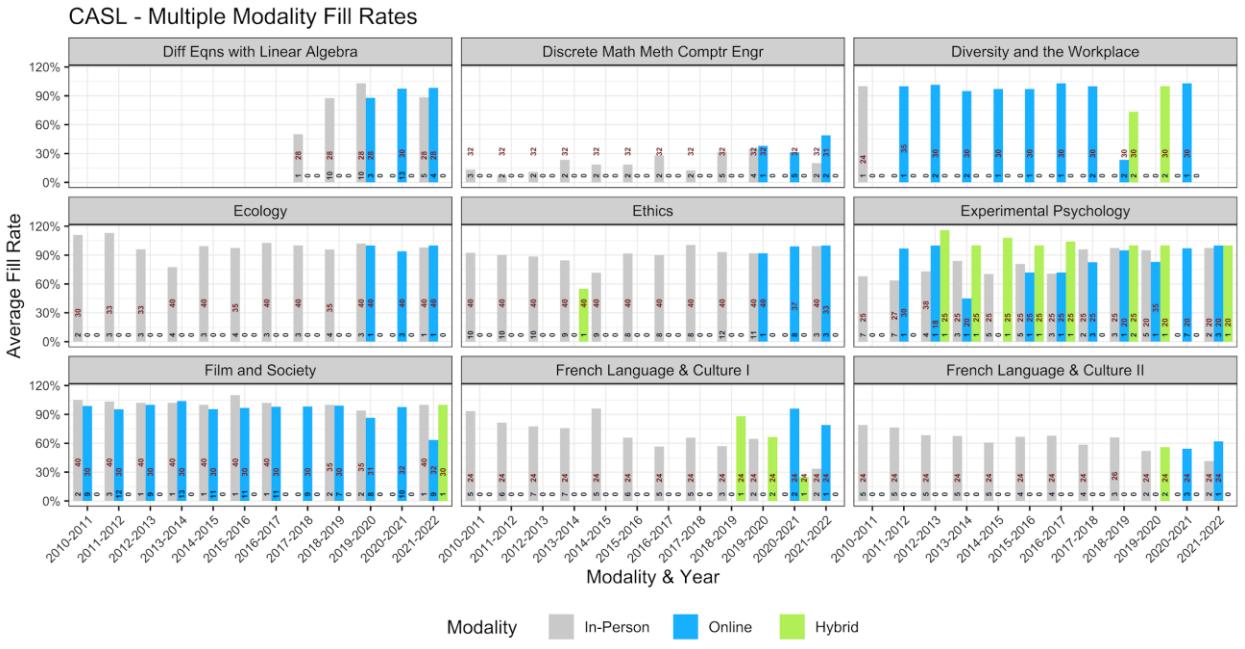
5.4 CASL - Multiple Modality Fill Rate Trends



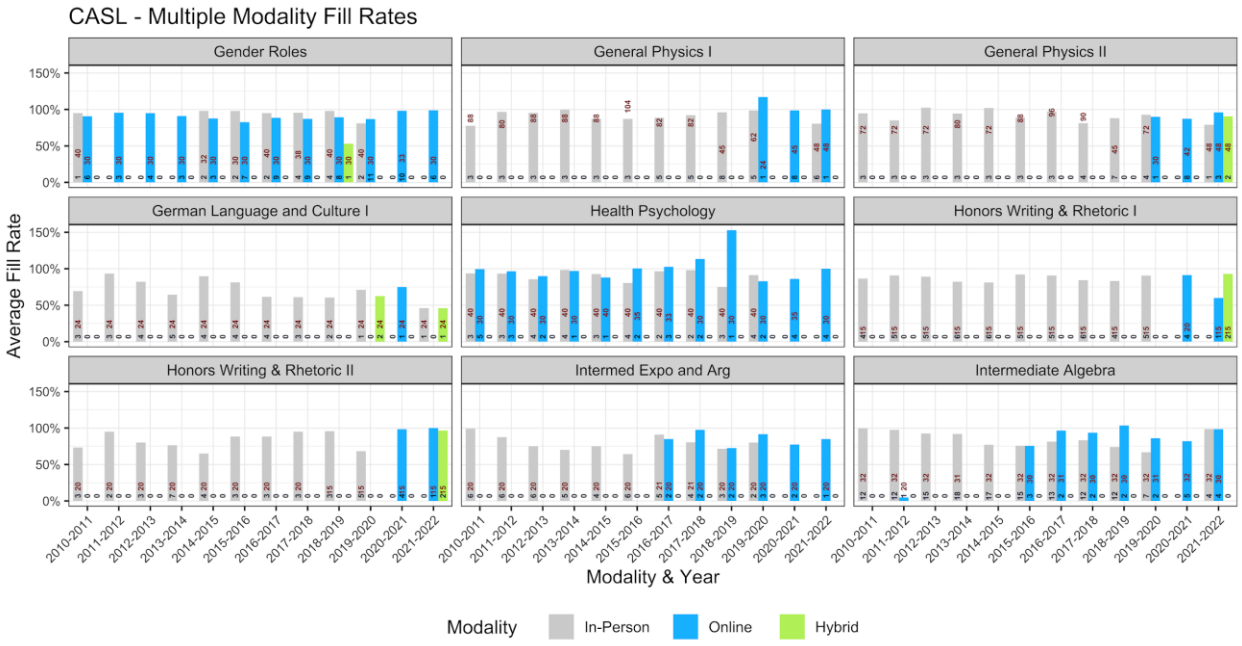
*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



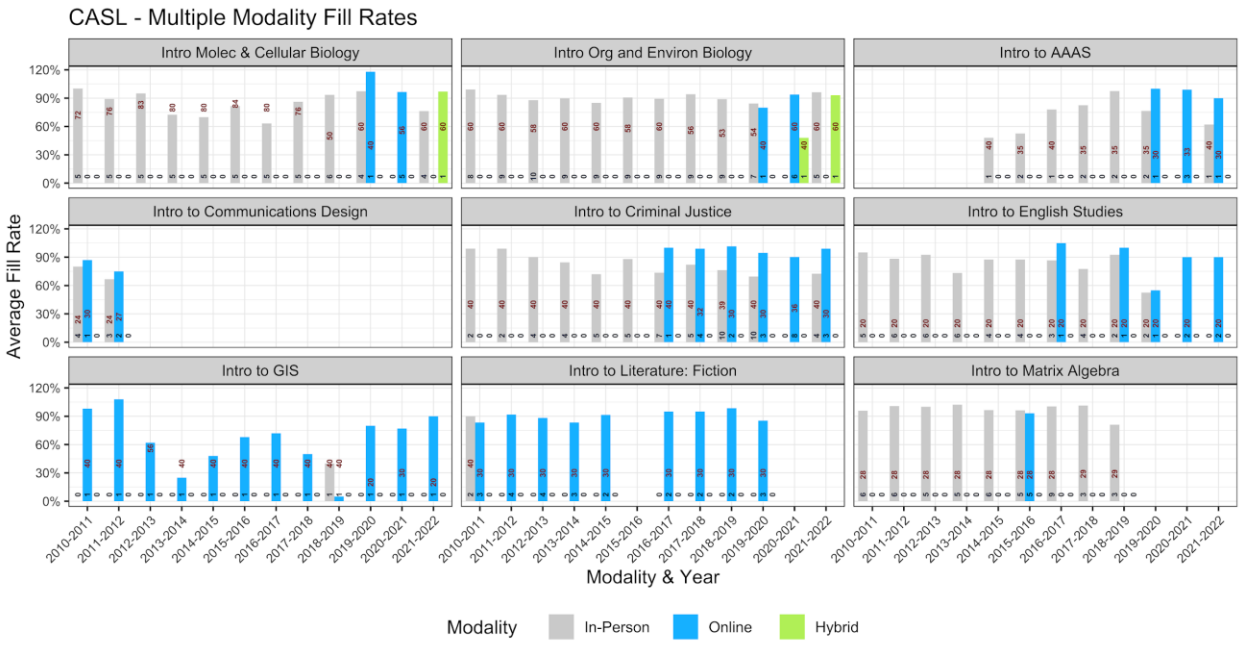
*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



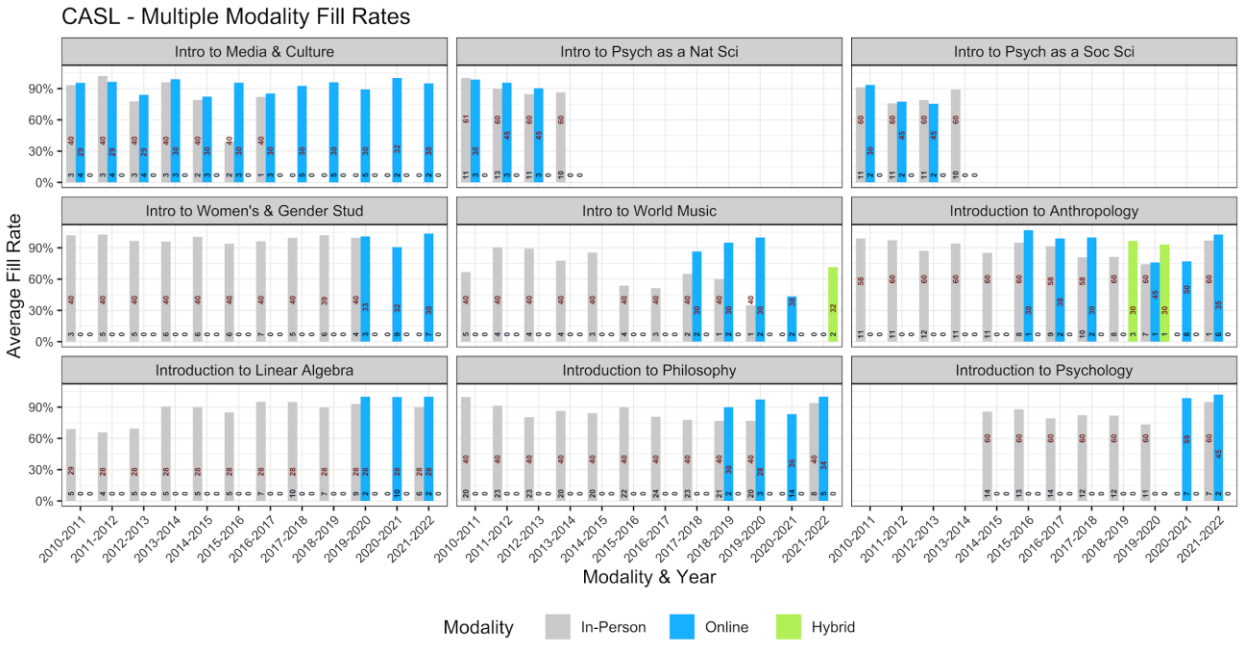
*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

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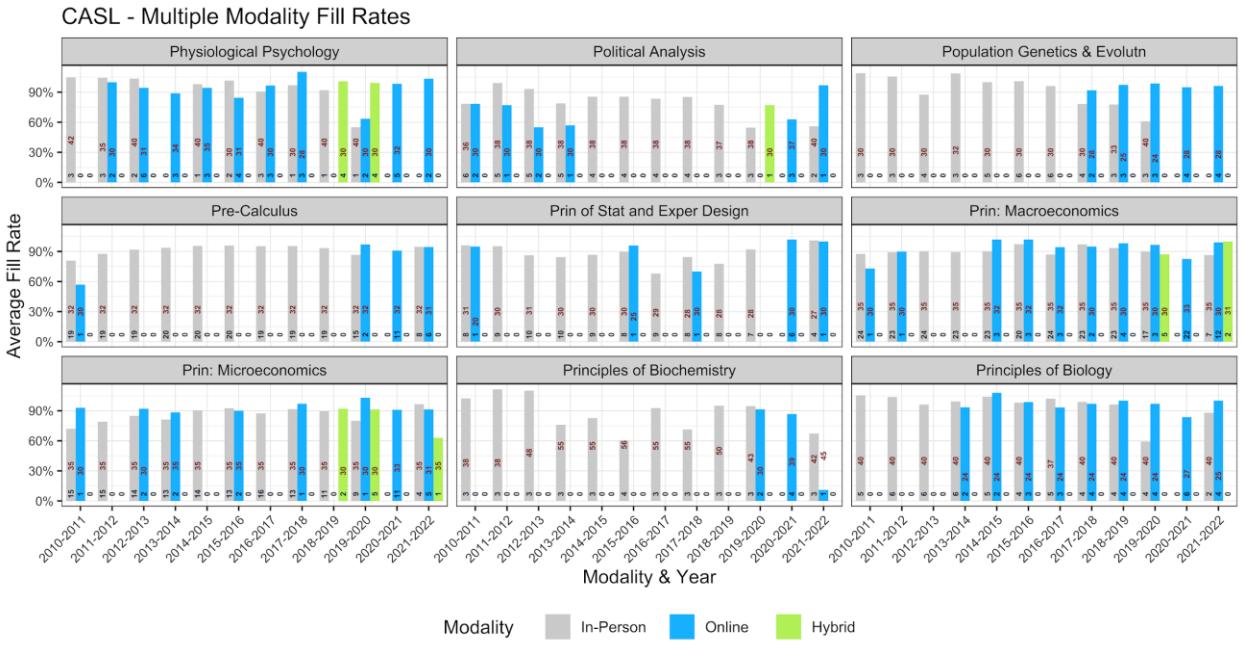

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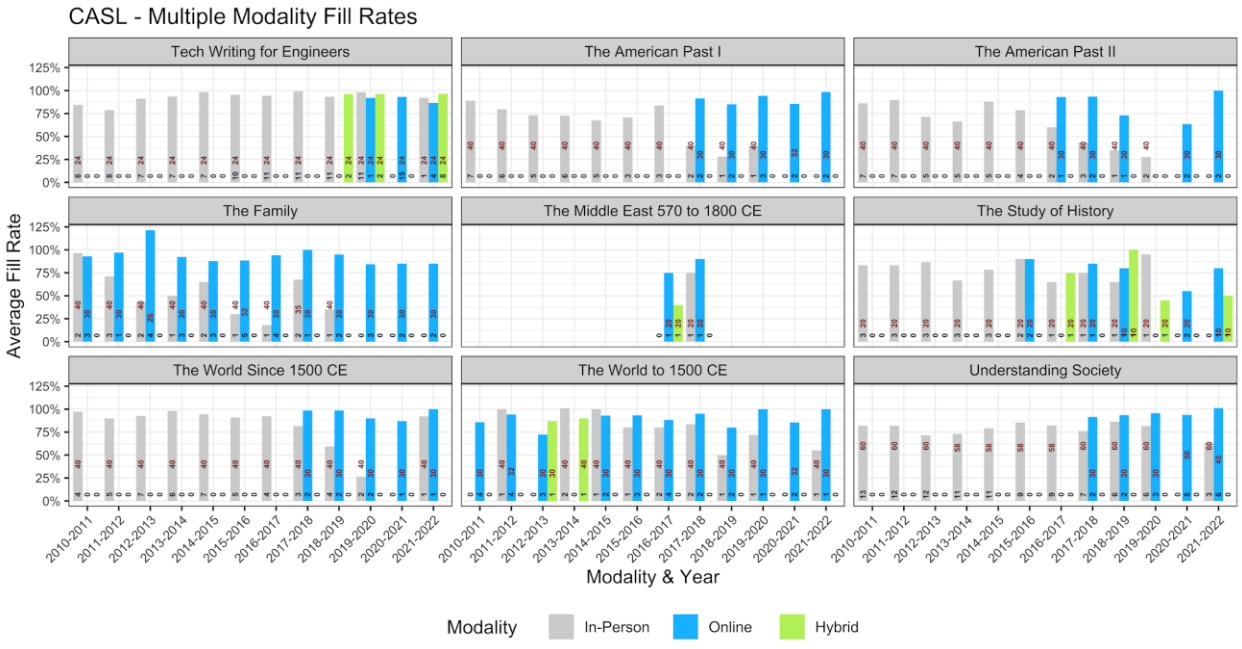
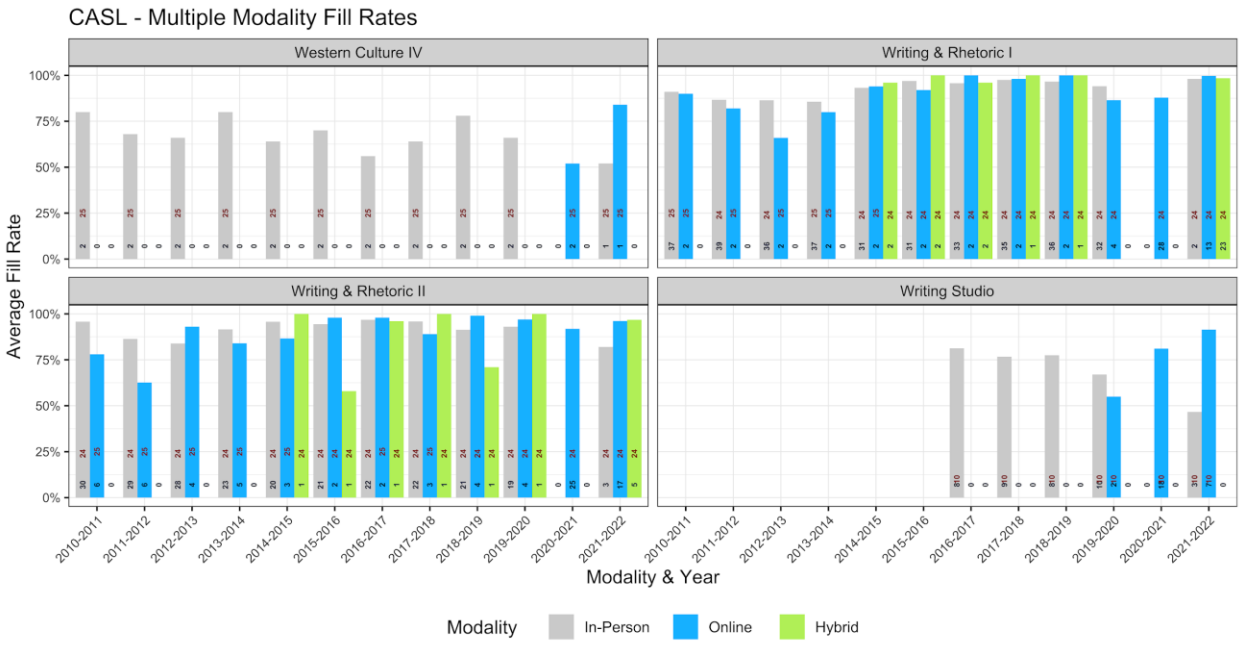


*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities



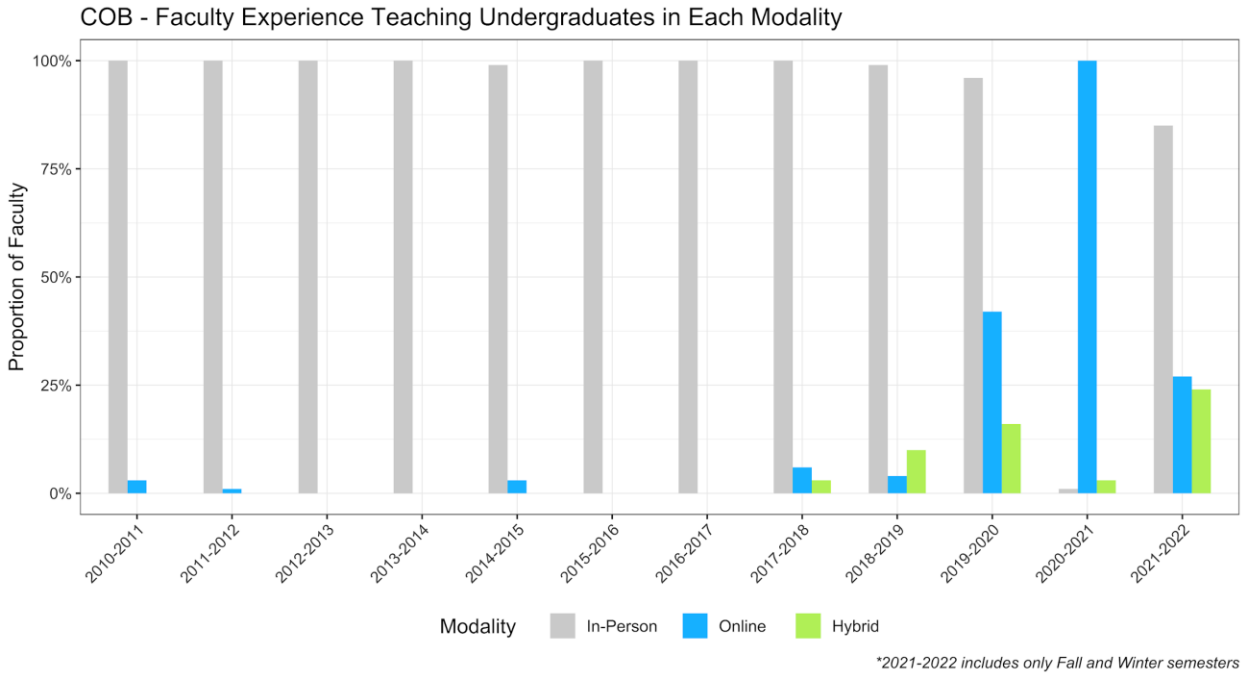
*2021-2022 includes only Fall and Winter semesters. **Black numbers show total number of courses offered. ***Red numbers show average course capacities

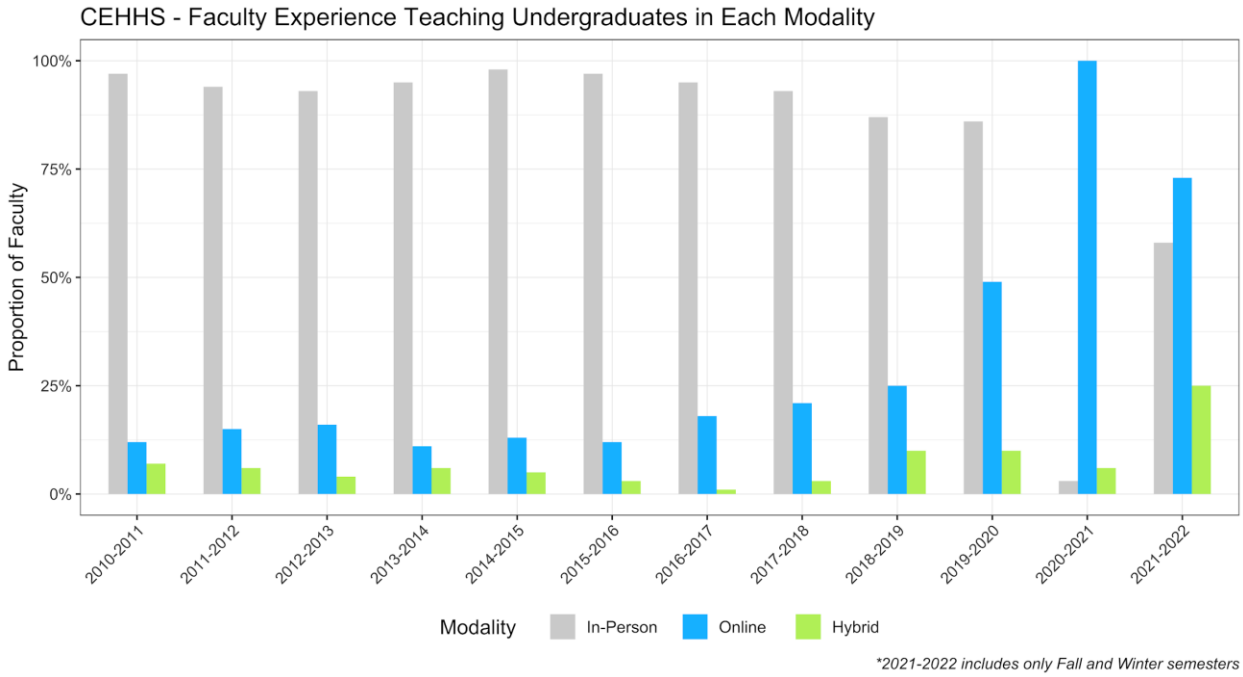
6 Trends in Faculty Experience with Online/Hybrid Modalities

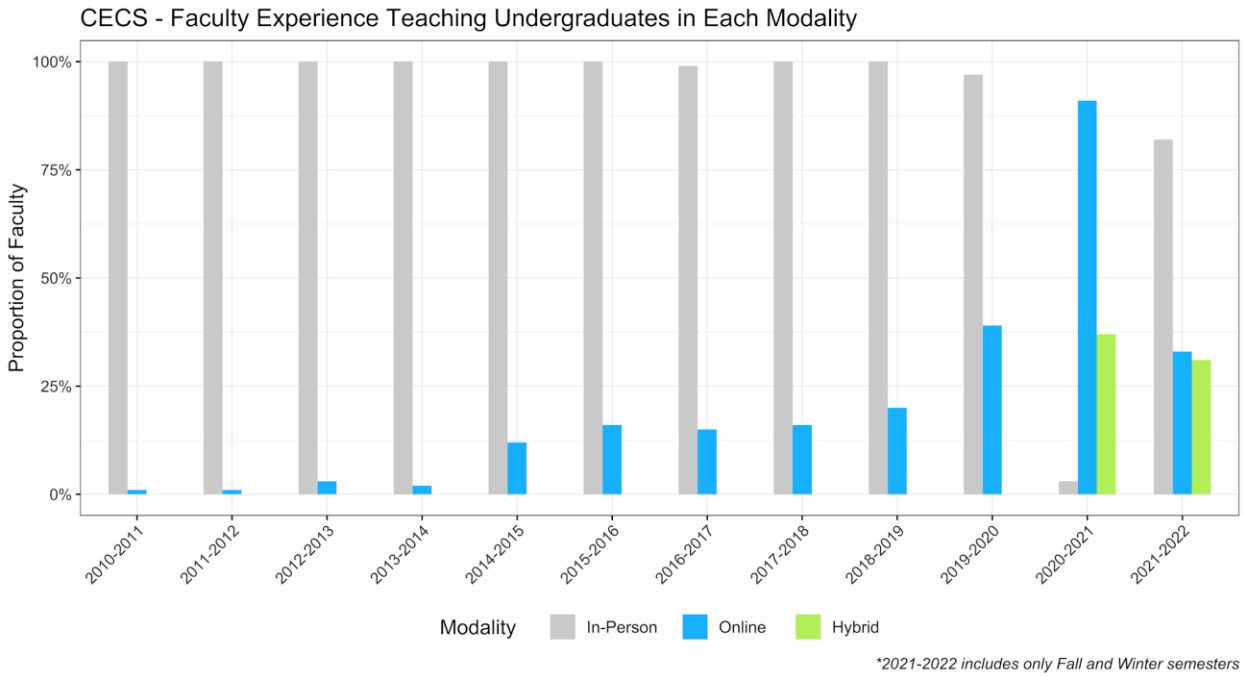
It is also possible to use the same data to identify faculty experience teaching in different modalities. To do this, the data is aggregated by instructor name and year, counting the number of individual faculty members who taught courses in each modality. This allows us to calculate the proportion of faculty members who taught a course in a given modality each year. Note that the proportions do not add up to 100%, because most faculty members teach more than one course, and these courses may not all be in the same modality. Thus, the following visualizations identify the proportion of total faculty (per college, each year) who taught at least one course in each of the three modalities.

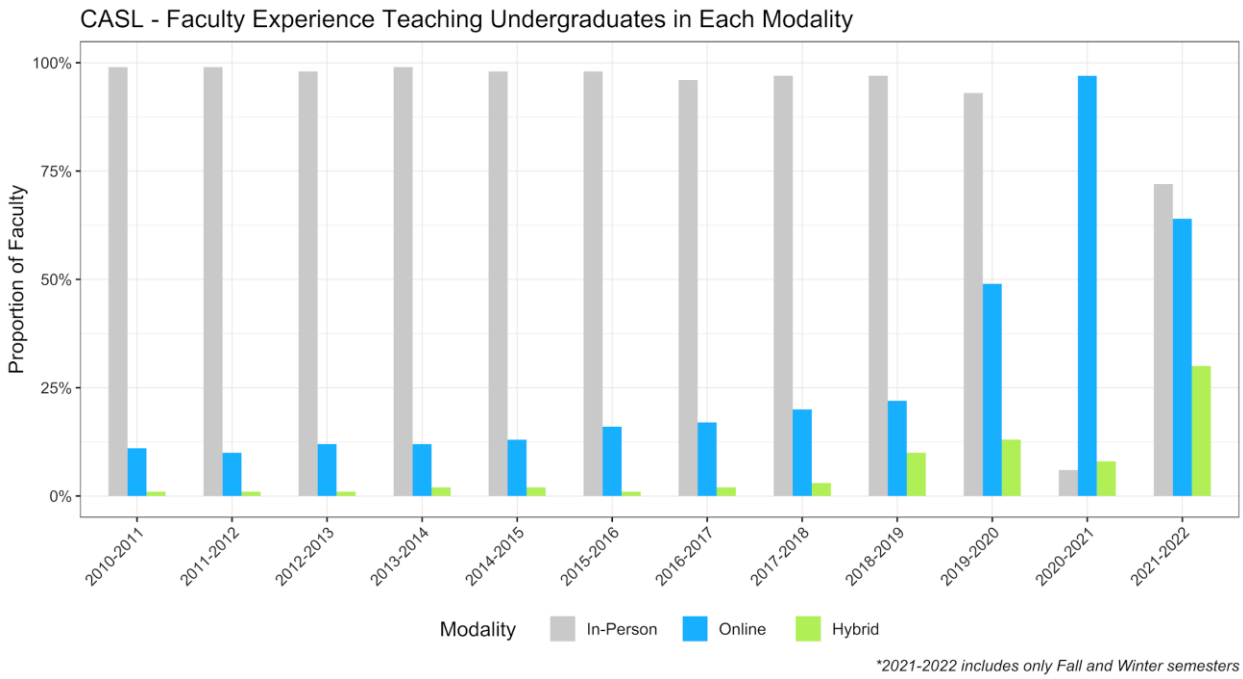
6.1 Faculty Experience with Undergraduate Online/Hybrid Modalities

What is immediately obvious here is that, a decade ago, very few faculty in any college taught either online or hybrid undergraduate courses. At most, less than 15% of faculty in CASL and CEHHS offered courses online. By 2018-2019, between 20-25% of faculty were teaching undergraduates online. However, almost all faculty teaching undergraduate courses were teaching at least one course in person, even for those faculty teaching online. The pandemic, obviously, completely changed that, with almost 100% of faculty teaching online. In 2021-2022, many faculty moved back to in-person teaching, but many faculty also continued teaching online at the same time, and a much higher proportion of faculty were teaching entirely online or hybrid (as the proportion of faculty teaching at least one in person course dropped visibly across all colleges).



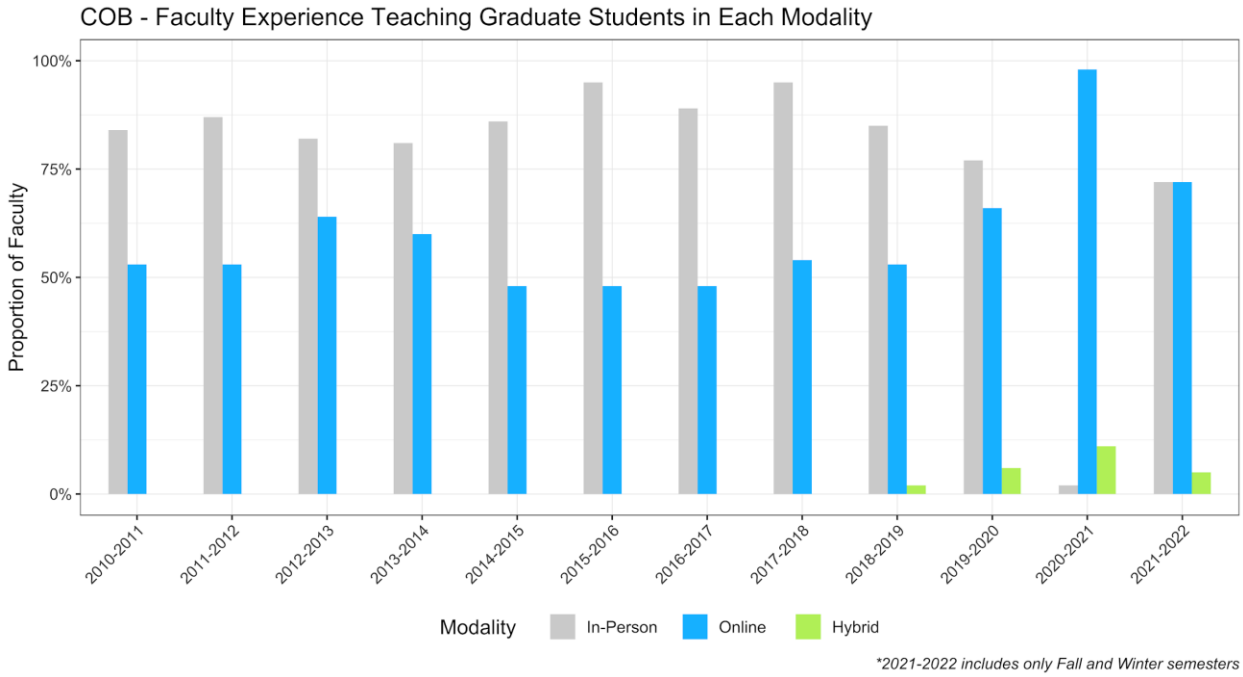

CEHHS - Faculty Experience Teaching Undergraduates in Each Modality
Proportion of Faculty
100%
75%
50%
25%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
Modality
In-Person
Online
Hybrid
*2021-2022 includes only Fall and Winter semesters


CECS - Faculty Experience Teaching Undergraduates in Each Modality
Proportion of Faculty
100%
75%
50%
25%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
Modality
In-Person
Online
Hybrid
*2021-2022 includes only Fall and Winter semesters

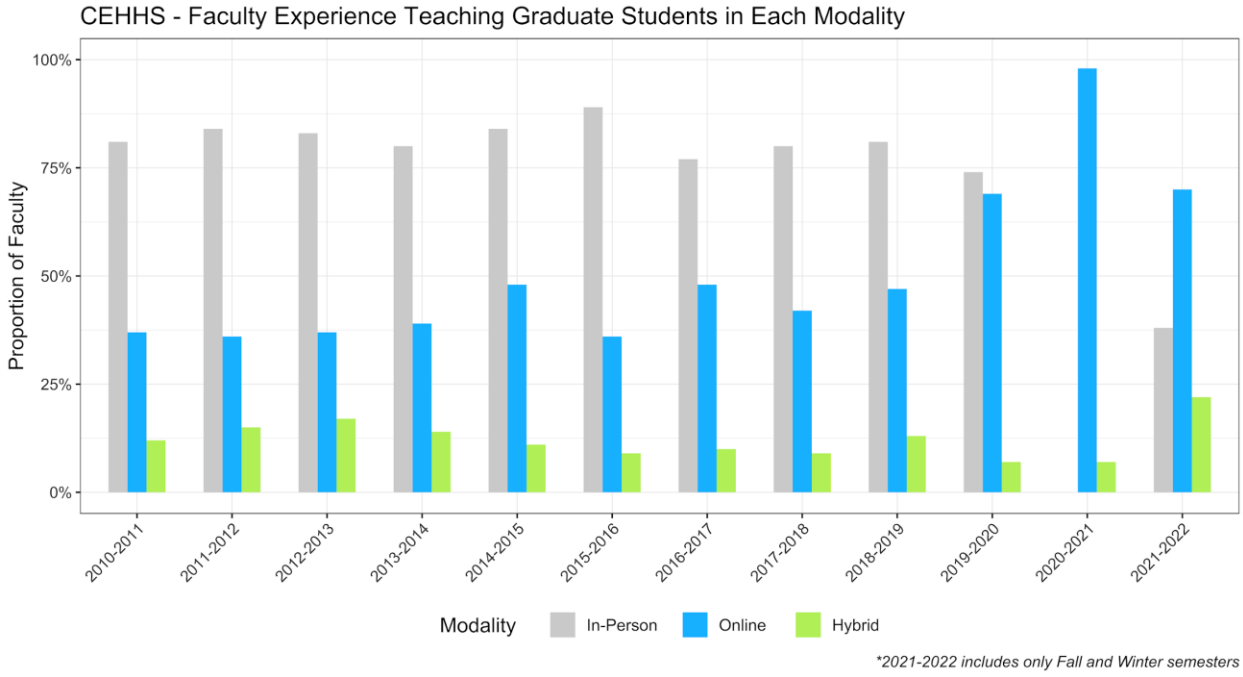


6.2 Faculty Experience with Graduate Online/Hybrid Modalities

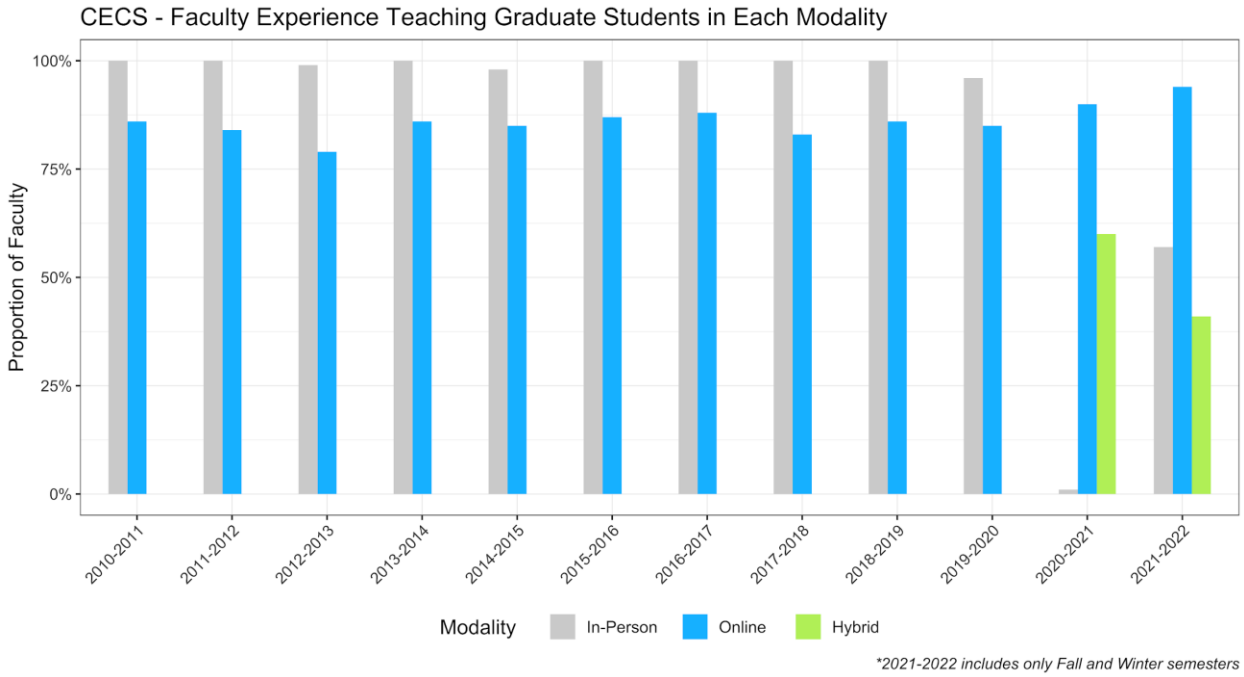
The pattern is very different for the graduate level. A huge proportion of COB (50%+) and CECS (75%+) faculty who teach graduate courses have been teaching online regularly since 2010. Over 35% of CEHHS faculty have been teaching graduate courses online since 2010, reaching nearly 50% by 2018-2019. Over that same time period, 15-25% of CASL faculty have taught graduate courses online. At the same time, over 75% of faculty in all four colleges were also teaching courses in person, indicating that most faculty teaching online were also teaching in-person courses at the same time (on a yearly basis, at least). While the pandemic has reduced the number of faculty teaching graduate courses in person, the proportion of faculty teaching hybrid graduate courses has increased recently, as well.

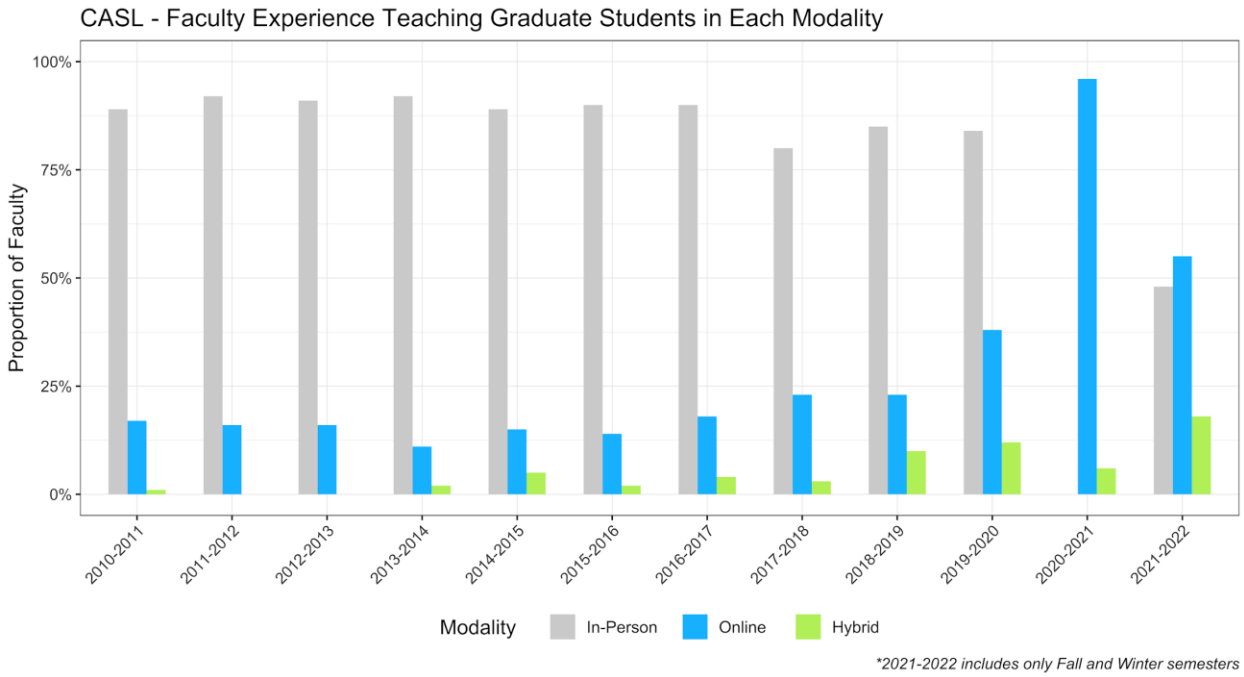


*2021-2022 includes only Fall and Winter semesters



*2021-2022 includes only Fall and Winter semesters

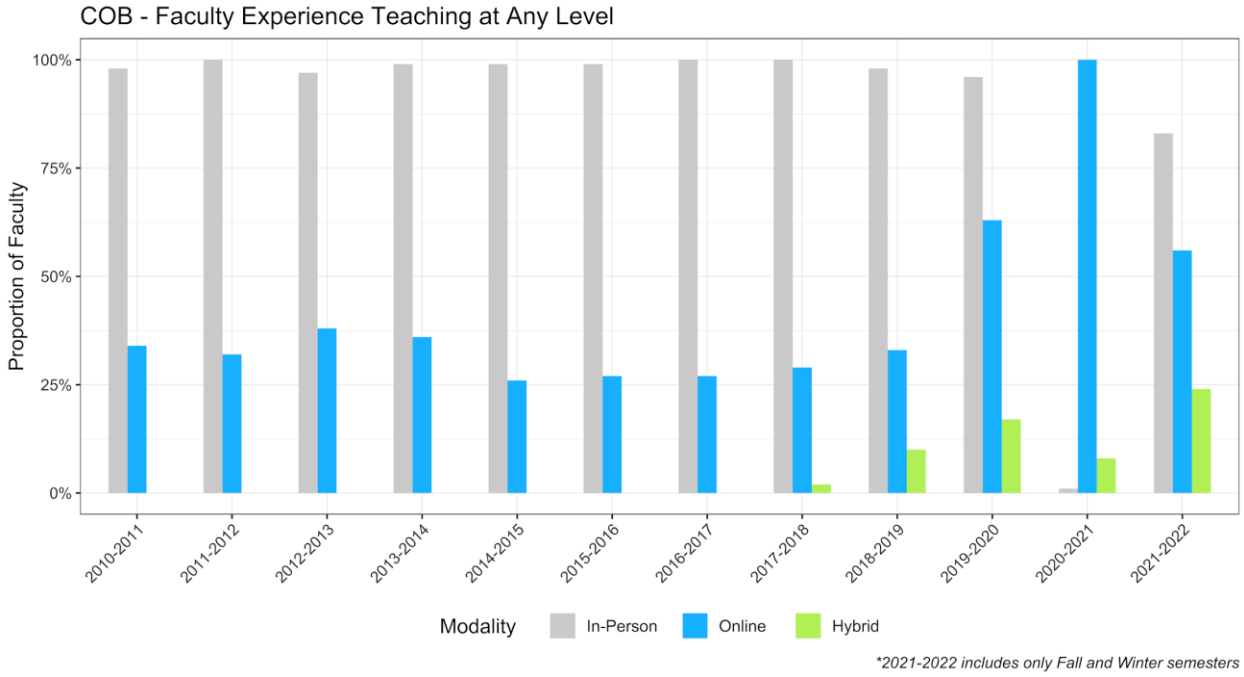


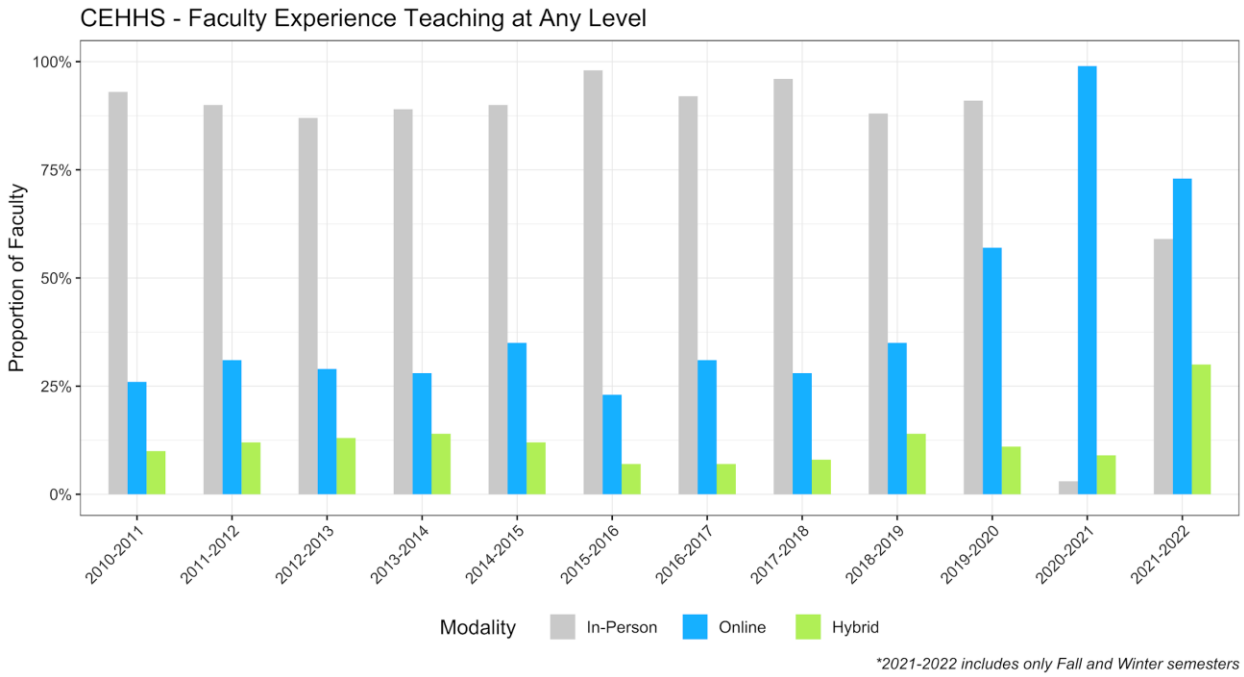


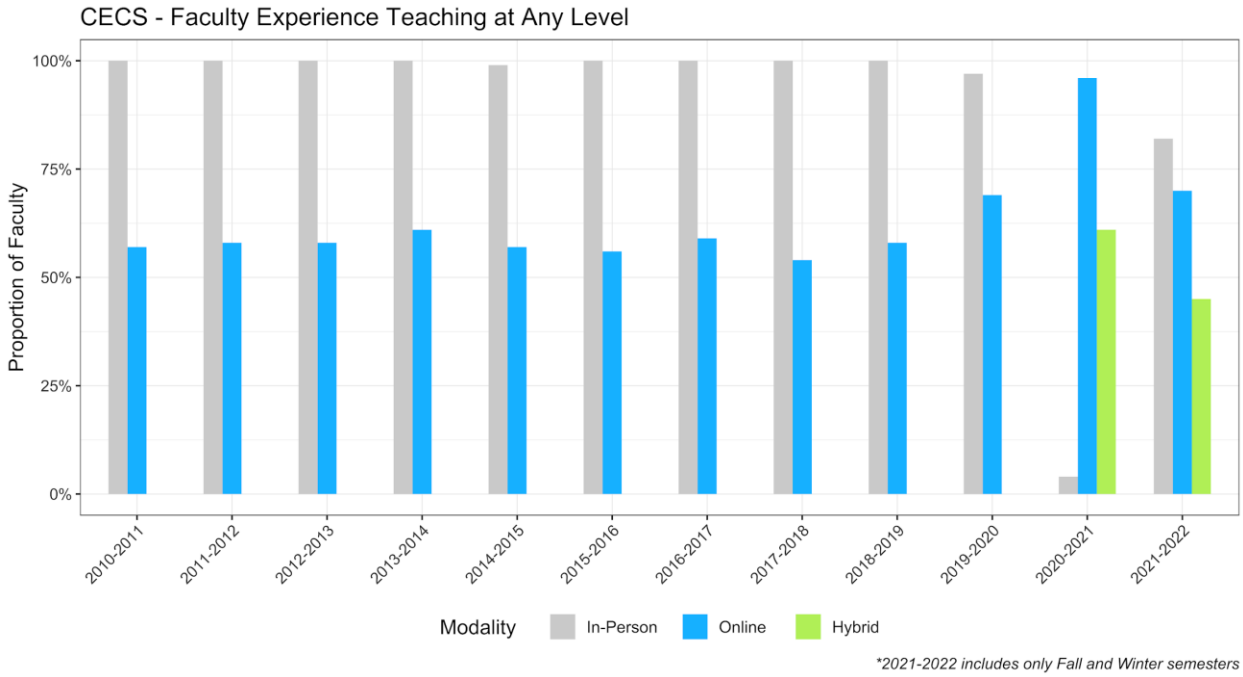
6.3 Faculty Overall Experience with Online/Hybrid Modalities

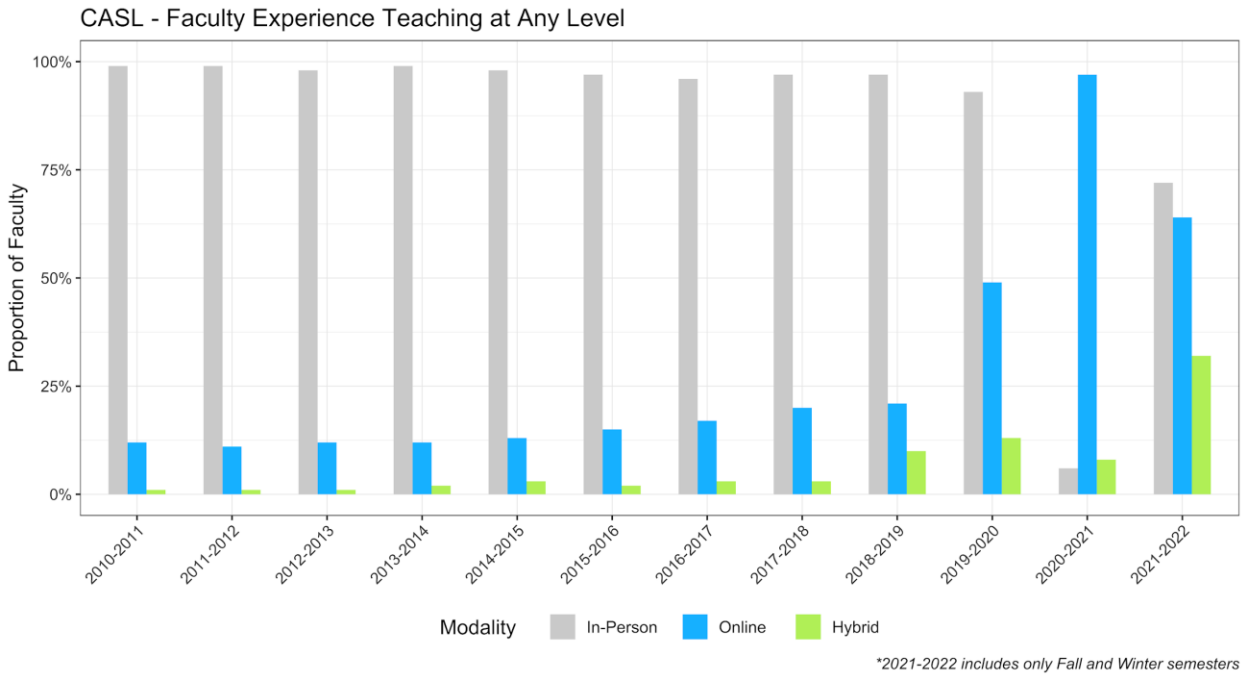
Across all faculty, regardless of course level (i.e. including both undergraduate and graduate courses), we can see what proportion of all faculty teaching at UM-Dearborn each year were teaching in each modality. Across all the colleges, we can see that preponderance of faculty were teaching at least one course in-person up to the pandemic. Interestingly, the proportion of

faculty teaching at least one class online has remained fairly steady for each of the colleges. From 2010-2019, ~25-35% of COB faculty, ~20-35% of CEHHS faculty, ~55-60% of CECS faculty, and 10-20% of CASL faculty taught online each year. Over the same time period, almost no faculty in COB or CECS, less than 3% of CASL faculty, and ~5-15% of CEHHS faculty taught hybrid courses.






CECS - Faculty Experience Teaching at Any Level
Proportion of Faculty
100%
75%
50%
25%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
Modality
In-Person
Online
Hybrid
*2021-2022 includes only Fall and Winter semesters


CASL - Faculty Experience Teaching at Any Level
Proportion of Faculty
100%
75%
50%
25%
0%
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
Modality
In-Person
Online
Hybrid
*2021-2022 includes only Fall and Winter semesters