Student Success Outcomes and Predictors from the 2019 Student Survey
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Averages of two student success measures, cumulative GPA and response to the survey question “To what extent have the Library’s resources and services contributed to your academic success?”, were estimated at two different levels of library resource usage and library building usage and for a variety of student groups, while adjusting for demographics and other predictor variables.

A library resource usage index was constructed from survey questions asking how frequently the respondent uses various library resources, producing an additive estimate of overall library resource use. Frequency of building usage was considered separately from library resources. Type of building space (individual or collaborative) and its importance/satisfaction to the respondent were also used as predictors, as was having received course-related instruction.

The variation of these averages and associations across groups was estimated for discipline, undergraduate class level/type of graduate degree program, and race/ethnicity groups. Even though some of these groups had few respondents, stable and conservative estimates were made by multilevel regression, where estimates are pooled and for groups with few respondents, shrunk towards the overall mean.

This analysis is descriptive and does not imply causality of library use on student success.

Plots show the median estimate of the average difference in the outcome variable between the two levels of the predictor as a dot or shape, with thick line segments showing the middle 50% of plausible values for this average difference, given the data, and thin line segments showing the middle 90%. There is a 50% chance of the real population difference being in the range of the thick segments, given our survey data, and 90% chance in the range of the thin segments. The wider the segment, the more uncertain is the estimate.
Undergraduates’ Cumulative GPA

Figure 1. Differences in predicted cumulative GPA compared at different levels of each predictor value, taking each predictor one at a time and adjusting for the other ones. Thin segments and thick segments represent the uncertainty of the estimate. Thick segments represent the middle 50% of the range of the estimates, while thin segments represent the middle 90% of the probable range of the estimates.

Received CRI: Unlike in the 2016 survey, where there was no difference or a lower GPA on average for students who received CRI compared to those who did not report CRI, in 2019, on average, those reported receiving CRI had a higher cumulative GPA by 0.07 than those who did not. This was a highly uncertain estimate with a wide range of plausible values, but there was a 97% probability the difference was greater than zero, given the data.

Library contributes ‘very much’ to success: Respondents with this attitude had on average higher cumulative GPAs by 0.04, after adjusting for all the other predictors. Although this estimate had a wide range of plausible values, including negative ones, the probability that the difference is greater than zero is 88%.

Building use: On average, undergraduates who use the library building four times per month compared to those who use it once per month have a higher cumulative GPA by 0.03. This estimate could range from a difference just below zero to 0.07, with a 95% probability that it is above zero.
**Resource use:** On average, undergraduates who, on our combined library resource use index, use resources four times per month compared to those who use them once per month also have a higher cumulative GPA, about the same difference compared to building use. The median estimate is a higher GPA by 0.03. On the lower end the range of estimates could include no difference in GPA, but there is a 91% probability it is greater than zero.

**Individual space:** Importance of and satisfaction with individual space in the library was rated on a five point scale. These two ratings were averaged, with “don’t use” assigned zero. On average, undergraduates who had an average rating of 4 compared to an average rating of 3 for individual space had a 0.01 higher cumulative GPA, with 74% probability the difference was above zero.

**Collaborative space:** Like individual space, importance and satisfaction with collaborative space was averaged. Unlike individual space, higher ratings for collaborative space predicted lower cumulative GPA for undergraduates with 84% probability that the average grade was lower, median estimate of -0.02. There were about 151 cases with missing values for these two variables.³

None of these comparisons necessarily indicate causation. Higher building use and library resource use could indicate students that generally put more effort into their studies or have more time to do so and may do more of other things that have more benefit. Explanations for the negative effect of collaborative space could include students socializing rather than working, or it could mean students with lower GPAs find that studying with groups helps them more than studying alone, among other possibilities.

The model adjusted for an indicator for zero use of library resources, gender, the average of cumulative GPA by college and class level/graduate status, the average library circulation by discipline and undergraduate/graduate type, undergraduate class level/graduate degree, sampling stratum, discipline, and race/ethnicity, besides the predictors shown in Figure 1.
Undergraduates’ perception of library’s contribution to their success

To what extent have the Library’s resources and services contributed to your academic success?
Undergraduates

Figure 2. Differences in probability of undergraduates responding “Very much” to the question “To what extent have the Library’s resources and services contributed to your academic success?” compared at different levels of each predictor value, taking each predictor one at a time. Thin segments and thick segments represent the uncertainty of the estimate. Thick segments represent the middle 50% of the range of the estimates, while thin segments represent the middle 90% of the probable range of the estimates.

The general pattern of these predictors for undergraduates’ cumulative GPA holds up for another outcome variable – the answer to “To what extent have the Library’s resources and services contributed to your academic success?” The probability of responding “Very much”, in contrast to the other possible answers (“somewhat”, “very little”, “not at all”, or no response) is predicted, while adjusting for each of the other predictors, as well as gender, the sampling stratum, undergraduate class or graduate degree, discipline, and race/ethnicity.

A frequency of four times per month compared to one time per month for both the library resource use index and building use predict 10% higher probability of responding “very much” to the question. A higher average of importance and satisfaction with individual space (4
compared to 3) predicts 8% higher probability, while the same for collaborative space predicts possibly 1% higher probability.

Hispanic or Latino undergraduates are 5% more likely than whites to respond “very much,” while Black or African Americans are 4% more likely.

**Graduate students’ Cumulative GPA**

![Figure 3](image)

Figure 3. Differences in predicted cumulative GPA compared at different levels of each predictor value, taking each predictor one at a time. Thin segments and thick segments represent the uncertainty of the estimate. Thick segments represent the middle 50% of the range of the estimates, while thin segments represent the middle 90% of the probable range of the estimates.

**Library contributes ‘very much’ to success:** Respondents with this belief had on average higher cumulative GPAs by 0.02, after adjusting for all the other predictors. Although this estimate had a wide range of plausible values, including negative ones, the probability that the difference is greater than zero is 88%.

**Resource use:** On average, graduate students who, on the combined library resource use index, use resources four times per month compared to those who use them once per month have a higher cumulative GPA. The median estimate is a 0.02 higher cumulative GPA, with a 93% probability the difference is greater than zero.

**Collaborative space:** Unlike the undergraduates, graduate students who rate the importance of and satisfaction with collaborative space higher (4 compared to 3) on average have a higher
cumulative GPA. The median estimated difference is 0.01, with a 95% probability the difference is greater than zero. This estimate is adjusted for frequency of building use, averaging over the frequency and compared with only the rating of collaborative space changed.

**Received CRI:** Graduate students who report receiving CRI have no discernible difference in cumulative GPA, compared to those who do not report CRI.

**Building use:** On average, graduate students who use the library building four times per month compared to those who use it once per month have an estimated -0.02 lower GPA, again in contrast to the undergraduates. There is a 93% probability that cumulative GPA is lower for those graduate students who use the building more.

**Individual space:** Again unlike the undergraduates, graduate students who rate the importance of and satisfaction with individual space higher (4 compared to 3) on average have a lower cumulative GPA. The median estimated difference is -0.02, with a 99% probability that they do have lower GPA. Again, this estimate is adjusted for frequency of building use.

**Graduate students’ perception of library’s contribution to their success**

To what extent have the Library's resources and services contributed to your academic success?

Graduates

![Diagram showing the perception of library's contribution to success for different categories such as Resource use, Building Use, Individual Space, Collaborative Space, Hispanic or Latino, International, Black or African American, American Indian or Alaska, Native Hawaiian or Other, Two or more races, Asian, and Unknown. The diagram includes increase/decrease in probability with 50% and 90% uncertainty intervals, comparing Race/Ethnicity to White subgroup.]
Figure 4. Differences in probability of graduate students responding “Very much” to the question “To what extent have the Library’s resources and services contributed to your academic success?” compared at different levels of each predictor value, taking each predictor one at a time. Thin segments and thick segments represent the uncertainty of the estimate. Thick segments represent the middle 50% of the range of the estimates, while thin segments represent the middle 90% of the probable range of the estimates.

The general pattern of these predictors for graduates’ cumulative GPA doesn’t hold up as well as it did for undergraduates for the other outcome variable – the answer to “To what extent have the Library’s resources and services contributed to your academic success?” The probability of responding “Very much”, in contrast to the other possible answers (“somewhat”, “very little”, “not at all”, or no response) is predicted, while adjusting for each of the other predictors, as well as gender, the sampling strata, undergraduate class or graduate degree, discipline, and race/ethnicity.

A frequency of four times per month compared to one time per month for the library resource use index predicts 13% higher probability of responding “very much” to the question. Building use predicts 7% higher probability of responding “very much” to the question; in contrast building use predicts a lower cumulative GPA.

A higher average of importance and satisfaction with individual space (4 compared to 3) predicts 1% higher probability of responding “very much” (with 87% probability the difference is greater than zero), while the same for collaborative space predicts a 1% lower probability. The direction for these two predictors is switched for cumulative GPA, where higher rating of individual space predicts lower GPA and higher rating of collaborative space predicts higher GPA.

Again as with undergraduates, Hispanic or Latino graduate students are 5% more likely than whites to respond “very much” after adjusting for the other predictors (different with 94% probability). International students are 4% more likely than white students to respond “very much”, and Black or African American students 3% more likely (different from whites with 80% probability.)

By class and type of degree, change from 2016 to 2019 for cumulative GPA

In comparing results from 2016 and 2019, four predictors from the previous models were left out: course-related instruction and perception that the library contributes “very much” to success because the association was very uncertain and did not contribute to the fit of the model; and the ratings of individual space and collaborative space because the questionnaires did not ask these questions the same way in the two different years.
The two-year model did include an indicator for zero library resource usage, which was allowed to be different for each year. This indicator showed a positive effect in 2016 but no effect in 2019, meaning that in our 2016 data set, some students had excellent grades while not using the library, but there weren’t as many examples of that in 2019. Including this indicator may have made the estimated increased GPA with increased library usage appear larger.

Besides the library resource use index and building use, the model also adjusted for year, gender, average cumulative GPA by undergraduate class year and college (by college for graduate students), the average library circulation by discipline and undergraduate/graduate type, the sampling strata, undergraduate class or graduate degree, discipline, and race/ethnicity.

**Figure 5.** Associations between cumulative GPA and frequency of library resource use and library building use, for each of undergraduate classes 1 through 4, and for Master’s degree and PhD graduate students, with results from 2016 and 2019.

For undergraduates, the association between more frequent library resource use and cumulative GPA (comparing the average predicted GPA where the library resource index is 4 times per month vs. 1 time per month) is steady across both years and all classes of
undergraduates at 0.05 to 0.06 higher GPA. The probability that the cumulative GPA is higher at the higher level of the library resource usage index is at least 99% for all classes, given the data.

The building use predictions vary, both across years and across classes of undergraduates. While more frequent building use (compared at 1 to 4 times per month) predicted lower cumulative GPA in 2016, it predicts higher GPA for classes 3 and 4 in 2019, while predicting lower GPA for classes 1 and 2. While it looks like the estimates might be different between 2016 and 2019 for all classes but class 2, the 90% credible intervals do overlap so that difference is not certain.

In 2019, more frequent building usage predicted a lower freshman GPA by 0.06 with 96% probability that the GPA was lower, given the data. For seniors, a 0.06 higher GPA with more frequent building use was predicted with 99% probability that it was an increase.

For graduate students, more frequent library resource use predicts higher GPA by 0.04 for master’s degree students (probability of it being higher is almost 100%, given the data) and by 0.02 for PhD students (probability it is higher is 93%) in 2019. This is possibly a little less than 2016 but the difference is not certain.

More frequent building usage predicts lower cumulative GPA for graduate students in 2019 as it did in 2016, by 0.01 for master’s students and 0.04 for PhD students. For PhD students the probability that GPAs are lower is almost 100%, given the data.
Cumulative GPA by discipline

Figure 6. Comparing the predicted average cumulative GPA at two levels of the library resource usage index: 4 times per month compared to one time per month, for both 2016 and 2019, for undergraduates by discipline.

In Figure 6, there is likely little difference between 2016 and 2019 for most of the disciplines for the association between higher cumulative GPA and more frequent usage of library resources, with the association being positive for most disciplines in both years and in all disciplines for at least one year. The median estimates for each year are not discernibly different as their 50% credible intervals overlap. For Mathematics & Computer Science, the estimate for higher GPA is might be higher in 2019 vs. 2016, although the 90% intervals overlap. Math & Computer Science, which in 2016 had a neutral or negative association between GPA and more frequent usage, in 2019 had the second highest positive association, predicting higher cumulative GPA of 0.09 with a library resource usage index of 4 times per month vs. once per month, with a 97% probability that the difference is greater than zero. While there are few Math & Computer Science students, the estimate is conservative since they are pooled towards the mean. For Social Sciences, the reverse may be true, with a negative or neutral association between GPA and library use in 2019 and a positive one in 2016.
Figure 7. Comparing the predicted average cumulative GPA at two levels of library resource usage: 4 times per month compared to one time per month, for both 2016 and 2019, for graduate students by discipline.

In Figure 7, there is basically no difference between years for most of the graduate disciplines. Veterinary Medicine shows the largest association between cumulative GPA and more frequent library resource usage, with 0.09 higher GPAs for students with library resource usage index of 4 times per month vs. once per month. Vet Med students have a much larger range of GPAs than other graduate students.

There may be a difference between 2016 and 2019 for Physical Science & Engineering students and Business & Economics students, with no association between library resource usage and GPA in 2019, compared to a positive association in 2016. Although the 50% credible intervals do not overlap for these two years, the 90% intervals do.
Undergraduates by Race/Ethnicity

This analysis used a similar model as for Figures 1 and 2, except that “Library contributes very much to success” was not adjusted for.

Figure 8 (Undergraduates). Comparing average predicted cumulative GPA for building use at 4 times per month vs. once a month and for a library resource use index of 4 times per month vs. once for each of the race/ethnicity groups. For each comparison, adjustments were made for each of the other predictors and a zero-use indicator, the average importance and satisfaction ratings of individual space and collaborative space, gender, discipline, CRI, class, and sampling stratum. Groups are sorted by size of resource use/GPA association.

Resource use: In all groups higher resource use predicted either little discernible difference or higher cumulative GPA, after adjusting for other factors. The median differences ranged from 0.01 for Native Hawaiian/Pacific Islander, with a probability of being greater than zero of 63%, to 0.05 for American Indian/Alaska Native and international students (probabilities greater than zero 91% and 93%), with most groups ranging around 0.03.

Building use: The association between cumulative GPA and more frequent library building use is either neutral or positive for all groups, ranging from -0.01 for Black or African Americans,
with 66% probability of lower GPA to higher GPA by 0.07 for the Hispanic or Latino and the unknown ethnicity groups (96% and 94% probability that the difference is positive).

**Graduate students by Race/Ethnicity**

Figure 9 (Graduate students). Comparing average predicted cumulative GPA at two levels of building use (4 times per month vs. once a month) and for library resource use index for each of the race/ethnicity groups. For each comparison, adjustments were made for each of the other predictors and a zero-use indicator, the average importance and satisfaction ratings of individual space and collaborative space, gender, discipline, CRI, class, and sampling stratum. Groups are sorted by size of resource use/GPA association.

**Resource use:** In most groups higher resource use predicted higher cumulative GPA, after adjusting for other factors. There were a few groups where it predicted little or no difference in GPA. The median differences ranged from about 0 for international and Native Hawaiian or other Pacific Islander groups to 0.03 for unknown, Hispanic/Latino, and American Indian/Alaska Native, to 0.04 for the White groups. The difference for other groups was 0.01 or 0.02, with at least 72% probability that the difference was greater than zero.
**Building use:** In no group was cumulative GPA predicted to be higher with higher building use. Either no difference or a lower GPA by up to 0.03 was predicted.

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3 Value of zero was assigned if building use was zero and if importance or satisfaction were not missing, the missing value was set to that, otherwise the value was set to 3. An indicator was included in the model where the value was originally missing.