4-20-2020

Library Services: Impact Analysis Spring 2018 to Fall 2018

Amanda M. Hagman
Utah State University, amanda.hagman@usu.edu

Lindsay Ozburn
Utah State University, lindsay.ozburn@usu.edu

Hayden Hoopes
Utah State University, hayden.hoopes@usu.edu

Erik Dickamore
Utah State University, erik.dickamore@usu.edu

Bradford R. Cole
Utah State University, brad.cole@usu.edu

Mitchell Colver
Utah State University, mitchell.colver@usu.edu

Library Services

IMPACT ANALYSIS

SPRING 2018 - FALL 2018

Powered by Academic and Instructional Services

Report Presented May 2019

Student Library Resource Use Influences Student Persistence to the Next Term

Amanda Hagman

Data Scientist, M.S.

Center for Student Analytics

Lindsay Ozburn

Assessment Coordinator, MA, MSLIS

Merrill-Cazier Library

Hayden Hoopes

Undergraduate Research Assistant

Center for Student Analytics

Erik Dickamore

Undergraduate Research Assistant

Center for Student Analytics

Brad Cole

Dean of University Libraries, MS and CA

Merrill-Cazier Library

Mitchell Colver

Manager & Analyst, Ph.D.

Center for Student Analytics

Students who accessed library resources experienced an increase in persistence to the next term compared to similar students who did not access library resources (DID = 0.017, $p < 0.01$).

Libraries are an essential element of learning on university campuses. The content housed within libraries supports academic exploration and growth. Physically, libraries are designed to provide access to materials and spaces that facilitate learning. This report explored the impact of student library resource use on student persistence to the next term.

METHODS:

Students library resource use was captured with EZ Proxy log-ins and library material check-outs. Students who had a record of using library resources were compared to similar students who did not have a record of library resource use. They were compared using prediction-based propensity score matching. Students who used library resources were matched with non-users based on their persistence prediction and their propensity to participate.

FINDINGS:

Students were 98% similar following matching. Participating and comparison students were compared using difference-in-difference testing. Those who accessed library resources were significantly more likely to persist at USU than similar students who did not use library resources (DID = 0.017, $p < .001$). The unstandardized effect size can be estimated through student impact. It is estimated that library resources assisted in retaining 278 (CI: 168 – 387) students each year who were otherwise not expected to persist.

Table of Contents

List of Tables

List of Figures

Do library resources influence student persistence to the next term?

WHY PERSISTENCE?

Student success can be defined in various ways. One valuable way to view student success is through progress towards graduation. Progress towards graduation reflects students acquiring the necessary knowledge and accumulating creditials that prepare them for graduation. Progress towards graduation can be measured through student persistence. Here, persistence is defined as term-to-term enrolment at Utah State University. As a measurement, persistence faciliates a quick feedback loop to identify what's working well and what can be better (Baer, Hagman, & Kil, 2020).

WHY USE ANALYTICS?

Higher education professionals labor to support student success in all its various forms, not just through persistence. However, professionals now have access to far more data than they can feasibly interpret and utilize to support student success without the help of analytics. Fortunately, USU has access to professional tools that can process and organize data into insights that have historically been hidden from view (Appendix A). University professions can leverage insights to directly influence student success (Baer, Kil, & Hagman, 2019). Indeed, analytics aligns with USU's mission to be a "premier student-centered land-grant institution" by allowing professionals to know what is going well and what could be better (see Appendix G for the evaluation cycle).

PERSISTENCE & LIBRARY RESOURCES

The library is the physical manifestation of the core values and activities of academic life (Kuh & Gonyea, 2003). Library resources are an essential part of the learning that takes place in higher education.

Libraries are designed to support student persistence as a location and resource for academic growth and exploration.

While not all library use can be captured in the form of data, a variety of systems are able to capture student use of services resources including:

- EZ Proxy logins
- Resource checkouts

This report explores the impact of these programs on sutdent persistence.

Student Use of Library Resources

SUMMARY STATISTICS HEADLINE

Analysis Terms	Sp18, Fa18
Analysis Campuses	All USU Campuses
Total USU Students for Analysis Terms	59,743 Students
Unique USU Students for Analysis Terms	34,369 Students
Total Library Use	205,558
Unique Library Use	23,380 Students
Total EZ Proxy Use	178,747
Unique EZ Proxy	21,325 Students
Total Check Outs	26,689
Unique Check Outs	4,310 Students

AMOUNT OF USE

During the Spring 2018 and Fall 2019 semesters, there were 225,185 recorded library uses. 8.7% of those uses come from faculty. The remaining 205,558 uses are generated from student library interactions. 87.0% of the interactions were obtained through EZ proxy access to library databases and resources. The remaining uses came from student check-outs.

There were 25,654 unique students who used library resources during Spring 2018 and Fall 2019. 36.9% of the unique students only used resources once during the semester. On average, students accessed library resources 6 times per semester; median use was slightly lower at 3 uses per semester. Central statistics were slightly higher for EZ Proxy (mean = 6, median = 4) than for library check-outs (mean = 5, median = 2).

Impact Analysis Results

SUMMARY STATISTICS

Overall Change in Persistence:	1.73% (1.05% to 2.41%)
Overall Change in Students (per term):	139 (84 to 193) Students
Analysis Terms:	Sp18, Fa18
Students Available for Analysis:	23,380 Students
Percent of Students Participating:	50%
Students Matched for Analysis:	16,092 Students
Percent of Students Matched for Analysis	61.0%

STUDENT IMPACT

Students who used library services during a semester experienced a signficant increase in persistence to the next term. The estimated increase in persistence is equivalent to retaining 278 (CI: 168 – 387) students each year who were otherwise not expected to persist. This represents an estimated $1,251,414.22 ($756,250.32 - $1,742,076.63) in retained tuition per year, assuming an adjusted tuition of $4,501.49 (see Appendix C for estimated tuition table).

PARTICIPANT DEMOGRAPHICS

Matching procedures for this analysis resulted in the inclusion of 68.8% of available participants. Students were 48.8% male, 88.5% Euro-American, 50.7% first-time college students, and 91.2% undergraduate.

Prior to matching, participating and comparison students were 79% similar based on propensity score and 84% similar based on predicted persistence. Following matching, the participating and comparison students were 98% similar for both.

PARTICIPANT

The sample utilized students all USU students, including students at the Logan and statewide campuses. USU-E campuses were excluded since they have their own library resouces. Non-degree seeking students were also excluded from the analysis.

Participating students had at least 1 record of library use via the EZ proxi or resource checkout. Possible comparison students *did not have a record* of any library service use. Thus, it is still possible that comparison students used library resources during the semester, given that many forms of use do not leave a record.

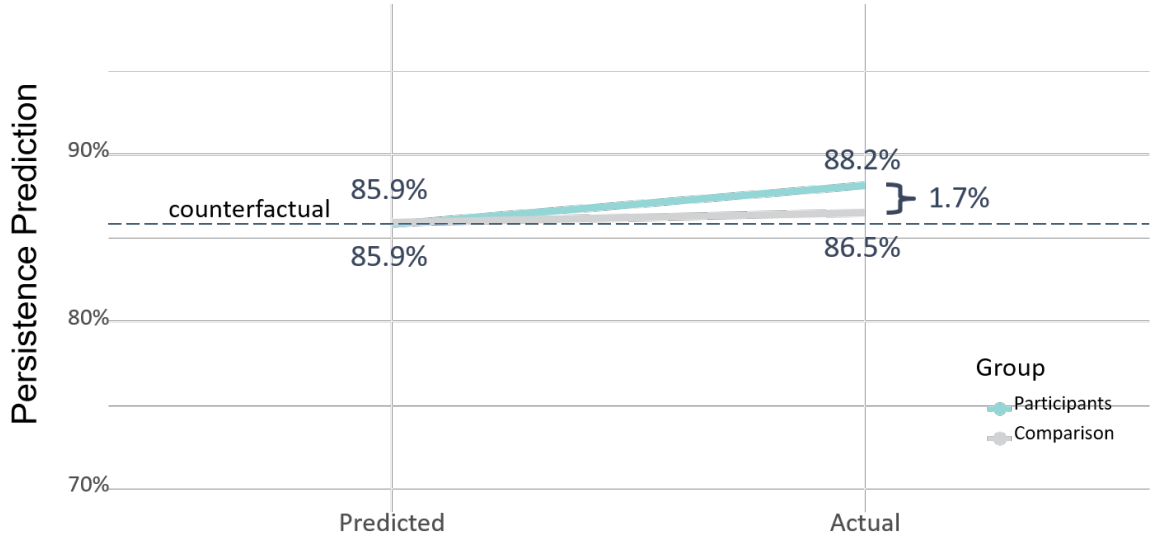


FIGURE 1

Participant and comparison students begin with highly similar persistence predictions. Actual persistence is significantly different between groups.

CHANGE IN PERSISTENCE

Change in persistence is measured using a difference-in-difference statistic that compares difference between the predicted presistence and actual persistence between participating and comparison students. Comparisons are made between matched pairs, which are optimized through prediction-based propensity score matching (see Appendix B for details).

After matching, students who used library resources and students who did not were 98% similar in their persistence prediction and 98% similar in their propensity to persist (Appendix E). On average, both participating students and comparison students were 85.9% likely to persist to the next semester. Actual persistence was significantly different between participant and comparison students: 88.2% for participants and 86.5% for comparison students.

IMPACT BY TERM

The impact of using library services was relatively stable between the semesters considered. Both Spring 2018 and Fall 2018 yielded significant differences between participaing and comparison students. The impact of each semester considered separately was consistent and reflective of the overall analysis, 1.73%.

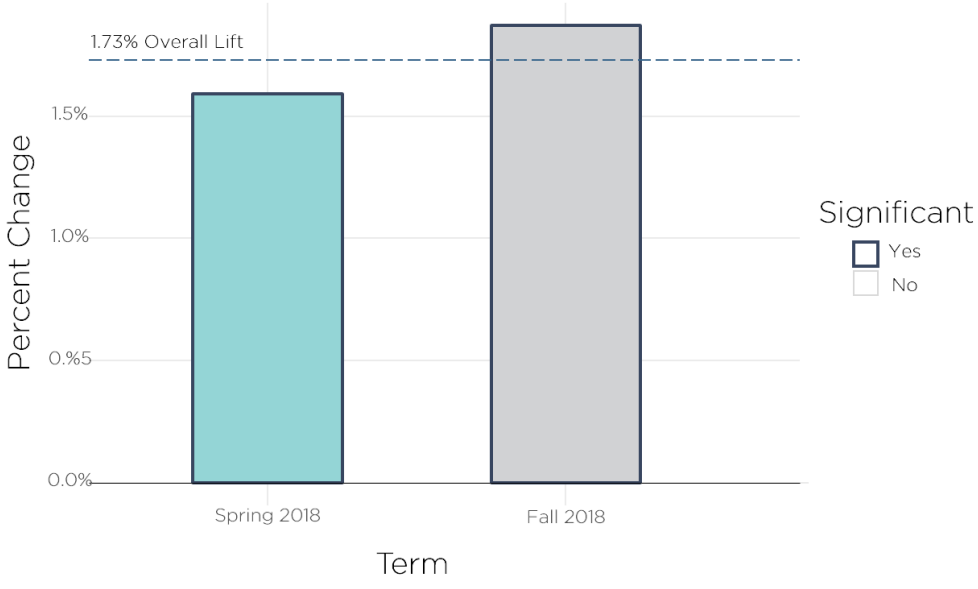


FIGURE 2

Change in persistence by term. Only fall semesters are shown because the majority of Passport activitiies happen during fall semester.

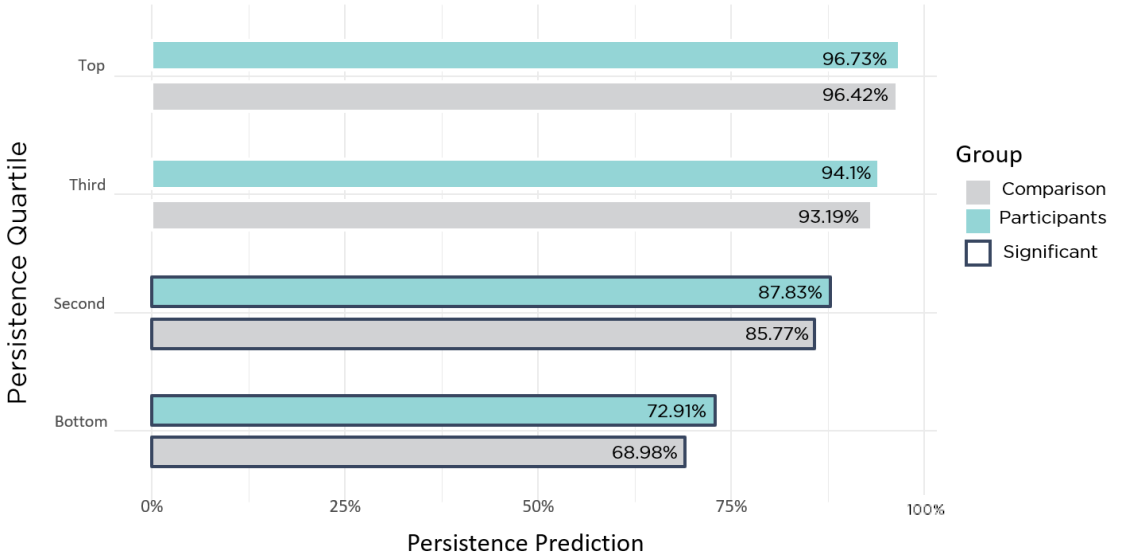


FIGURE 3
Actual persistence by predicted persistence quartile for participanting and comparison students.

Impact by Persistence Quartile

STUDENT PERSISTENCE

Illume Impact utilizes historical data to predict student persistence to the next term. The library services influence students in the bottom and second persistence quaritles (students between the 1st and 49th persistence quartiles). In general, students in the bottom and second persistence quartiles were the most likely to leave USU; they also have the greatest potential for impact.

The largest impact was experienced among students in the bottom persistence quartiles (the students most likely to leave USU). The estimated difference in persistence between participating and comparison students was 3.78%. This reflects approximately 34 students per year who persisted who were otherwise not expected to persist.

Impacted Student Segments

Illume Impact provides an analysis that looks at various student segments to identify how the program influenced students with specific characteristics. Please note that the student segments were not mutually exclusive. Table 1 shows all student groups who experienced a significant change from participating. Appendix D lists all subgroups with non-significant findings.

Impact by Gender: Both males and females experienced a significant increase in persistence from using library services, 1.77% and 1.69% respectively.

Impact by Ethnicity and Race: USU has a high population of White or Caucasian and non-Hispanic or Latino students. For this reason, Impact analyses can often detect change in persistence for these groups; however, students of other races or ethnicities rarely reach the critical mass necessary to detect a significant change. With this in mind, the analysis found a significant increase in persistence for Caucasian and non-Hispanic/Latino students.

Impact by Student Type: Using library services influenced student persistence for first-time college students and transfer students. Readmitted students did not experience a significant change in persistence from using library services.

Impact by Course Modality: Students with any course modality (all on -ground, all online, and mixed) experienced a significant increase in persistence from using library services. The lift was especially prominent for all online students, 4.47%.

Student Segment Impact

TABLE 1:

Student Segments Experiencing a Significant Change From Participating

N	Student Group**	Actual Persistence		Difference-in Difference	CI	Lift in People
		Participant Persistence	Comparison Persistence			
16,092	Overall	88.18%	86.53%	1.73%	0.68%	278
15,731	Not Hispanic or Latino	88.21%	86.61%	1.72%	0.69%	271
14,676	Undergraduate Students	87.82%	86.12%	1.75%	0.72%	257
14,244	White or Caucasian	88.57%	86.72%	1.87%	0.72%	266
12,132	Non-STEM Major	87.65%	84.98%	2.25%	0.83%	273
11,743	Full-time Courses	90.99%	90.63%	1.31%	0.72%	154
9,507	All On-Ground Status	88.31%	86.85%	1.55%	0.87%	147
8,236	Female Students	87.43%	85.36%	1.69%	1.00%	139
8,153	First Time in College	89.00%	87.70%	1.71%	0.94%	139
7,855	Male Students	88.96%	87.69%	1.77%	0.93%	139
5,937	1-3 Terms Completed	84.96%	82.37%	3.12%	1.24%	185
5,060	Mixed or Blended Status	90.38%	89.22%	1.25%	1.14%	63
4,396	Second Persistence Prediction Quartile (25th - 49th Percentiles)	87.83%	85.77%	2.02%	1.40%	89
4,342	Part-time Courses	80.61%	77.51%	2.65%	1.57%	115
3,681	Bottom Persistence Prediction Quartile (1st - 24th Percentiles)	72.91%	68.98%	3.78%	2.01%	139
3,098	Transfer Students	89.64%	87.45%	2.14%	1.50%	66
2,156	0 Terms Completed	86.43%	84.30%	2.06%	1.96%	44
1,524	All Online Status	80.12%	75.58%	4.47%	2.85%	68

* Student segments with fewer than 250 students are considered too small for reliable analysis **A list of student segment definitions can be found in Appendix F

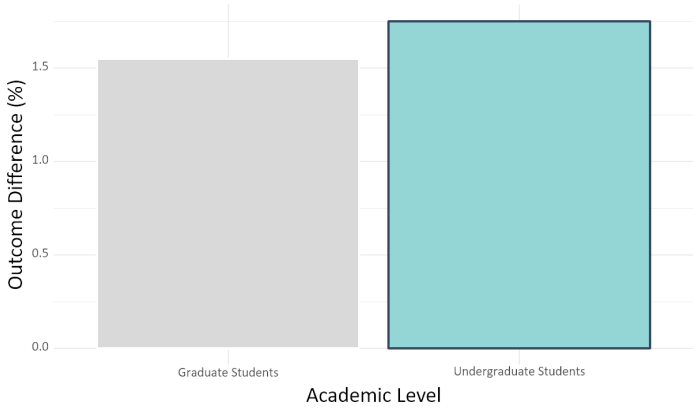


FIGURE 4
Change in persistence by academic level.

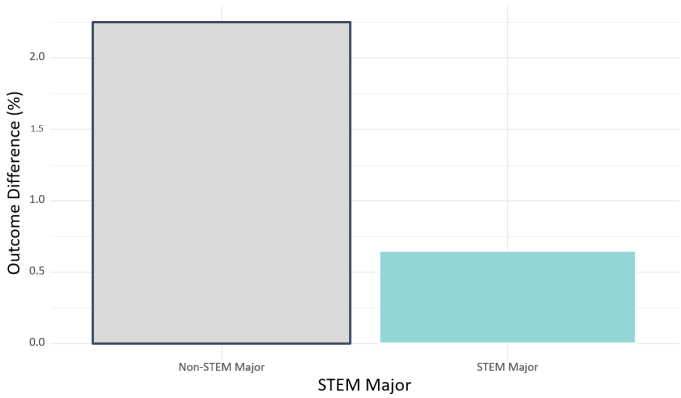


FIGURE 5
Change in persistence by major type.

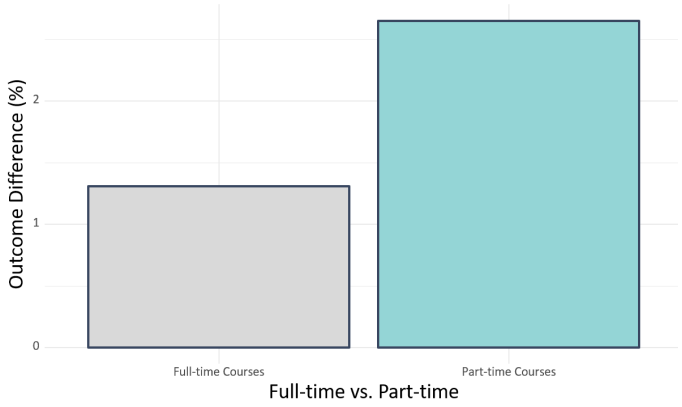


FIGURE 6
Change in persistence by time status.

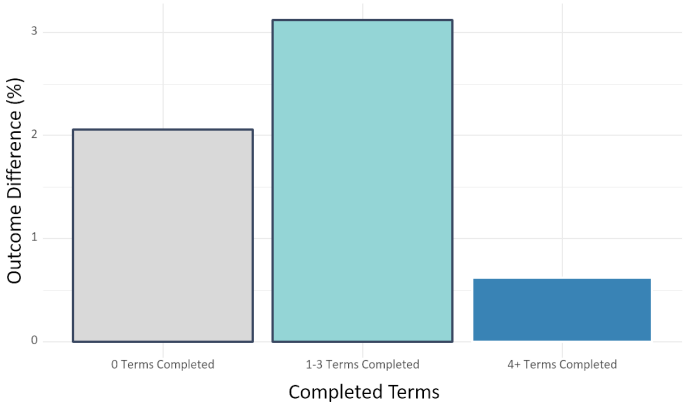


FIGURE 7
Change in persistence by terms completed.

SIGNIFICANT STUDENT SEGMENT

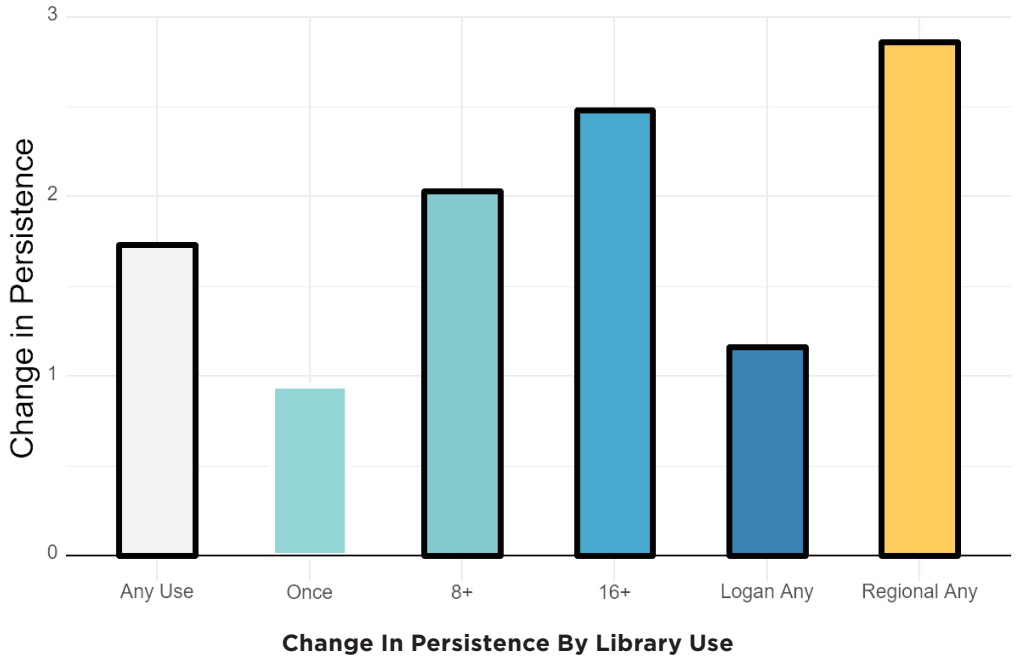
Impact by Student Subgroup [Continued]

Impact by Academic Level (Figure 4): Undergraduates experienced a significant increase in persistence from using the library services. Graduate students did not.

Impact by Major (Figure 5): Using library services impacted students who were Non-STEM majors. There was not a statistically significant difference between STEM majors who used or did not use library services.

Impact by Time Status (Figure 6): Both full-time and part-time students experienced a significant increase in persistence from using library services. This increase was especially large for part-time students, 2.65%. This reflects retaining 28 part-time students who were not otherwise expected to persist.

Impact by Completed Terms (Figure 7): Using library services impacted students who were early in their academic career. Students who were in their first term had a lift of 2.1%. Students who had completed 1 to 3 terms experienced a large lift, 3.15%. Students later in their academic career did not experience a significant change.



Change In Persistence By Library Use

FIGURE 8
Change in persistence across multiple analyses. Percentages reflect the proportion of students from the original included in the subsequent analyses.

Additional Analyses

INVESTIGATING THE EFFECT OF LEVEL OF PARTICIPATION ON PERSISTENCE

Library resources are regularly available to students. With this in mind, it was important to explore the impact of level of participation. Three different dosage levels were tested for library use, in addition to "any" use that was discussed in the sections above.

Single occassion use refers to students who had only one record of library use during a semester. 32.2% of students fell into this use type. Students with a single record of use did not experience a signficant change in persistence from using the library. Students who accessed library resources 8 or more times (45.7% of students), roughly every-other-week during a semester, experienced a significant increase in persistence compared to similar students who did not access library resources at all. Similar results were seen for students who used library resources on 16 or more occassions (19.1% of students).

There appears to be a dosage effect that favors regular use of library resources.

INVESTIGATING THE EFFECT OF CAMPUS ON PERSISTENCE

Library resources can be accessed by all USU students regardless of campus location. USU-E has library resources on-site (and were not included in the analysis), but other regional site rely on the abundant library resources available through the library physically located in Logan.

While the library is located in Logan, USU invests resources to support the access and understanding of available resources for state-wide and online students. For this reason, an analysis was used to investigate the impact of library resources on Logan and state-wide sites.

The majority of USU students available for the analysis attended at the Logan main campus, 62%. The remaining 38% attended at a regional or state-wide location. Interestingly, 76% of the recorded library accesses were made by Logan main campuses. This is significantly more than would be expected from the actual distribution of students across USU's many sites and campuses.

Comparison of Student Segments Across Analyses

TABLE 2:
Student Segments Experiencing a Significant Change From Participating Across Multiple Analyses

Student Subgroup	Any	Any Logan	Any Regional	Only 1	3+	6+
0 Terms Completed			X			
1 - 3 Terms Completed	X	X	X		X	X
4+ Terms Completed						
All On-Campus	X			X		
Online or Broadcast	X		X		X	
Mixed or Blended Course Modality	X		X		X	
Full-time Students	X				X	
Part-time Students	X	X	X			X
First Time in College	X		X			
Transfer Students	X		X		X	X
Readmitted Students						
STEM						
Non-STEM	X	X	X		X	X
Top Persistence Prediction Quartile			X		X	X
Third Persistence Prediction Quartile	X					
Second Persistence Quartile						
Bottom Persistence Quartile	X		X			
Female	X		X		X	X
Male	X					
Undergraduate Students	X	X	X		X	X
Graduate Students	X		X			

TABLE 2: [CONTINUED]

Student Subgroup	Any	Any Logan	Any Regional	Only 1 Regional	3+	6+
Non-Hispanic or Latino	X	X			X	
Hispanic or Latino						
Race: Two or More						
Race: Unknown						
Race: Asian						
Race: Black or African American						
Race: Pacific Islander						
Race: American Indian/ Alaskan Native						
Race: White or Caucasian	X	X	X		X	X

Does checking-out library resources influence student persistence?

SUMMARY STATISTICS HEADLINE

Overall Change in Persistence:	0.75% (-0.32% to 1.82%)
Overall Change in Students (per term):	NA
Analysis Terms:	Sp18, Fa18
Students Available for Analysis:	5,304 Students
Percent of Students Participating:	10.0%
Students Matched for Analysis:	5,203 Students
Percent of Students Matched for Analysis	98.1%

CHECK POINT

10% of students checked out a library resource.

Impact by Student Segment

STUDENT IMPACT

Students who checked-out a library resource did not experience a significant change in persistence to the next term.

PARTICIPANT DEMOGRAPHICS

Matching procedures for this analysis resulted in the inclusion of 98.1%, a very high match rate. Students were 48.7% male, 83.8% Euro-American, and 50.9% first-time college students. Students are 88.0% undergraduate.

PARTICIPANT

The sample included students across all USU campuses and academic levels. Non-degree seeking students were excluded from the analysis.

Participating students had at least 1 record of a library check-out. Possible comparison students did not have a record of library resource check-outs. It is possible, then, that comparison students used other library resources.

LIBRARY RESOURCE USE

There are 23,380 records of library engagement.

Checked-out resources account for 22.7% of these records.

Additional Analyses

EXPLORING CONTEXT & DOSAGE

Students can check-out library resources multiple times and from multiple locations each semester. We conducted additional analyses that looked at the impact by location and dosage.

Impact by Campus. Isolating the students who checked-out resouces by campus did not find a significant impact. Students in Logan and at state-wide campuses did not experience a signficant change in persistence from checking-out books.

Dosage. We tested impact of checking-out library resouces at 1, 2, and 4 occurances during the semester. The analyses with 1 or 2 check-outs were non-significant. At 4 check outs, the analysis became significant, a 1.2% (CI: 0.3% to 2.1%; Figure 10). This analysis included 8,629 students and reflects an estimated 25 (CI: 12 to 90) students who persisted to the next term who were otherwise not expected to persist.

The analysis drilled down to the subgroups that experience significant differences from checking out 4 or more library resources during a semester, the are listed here:

- All Online Students
- Transfer Students
- Bottom Persistence Quartile Students
- Part-time Students
- 1-3 Terms Complete
- Female Students
- Non-STEM students
- Undergraduate Students
- Euro-Americans and Non-Hispanic/ Latino

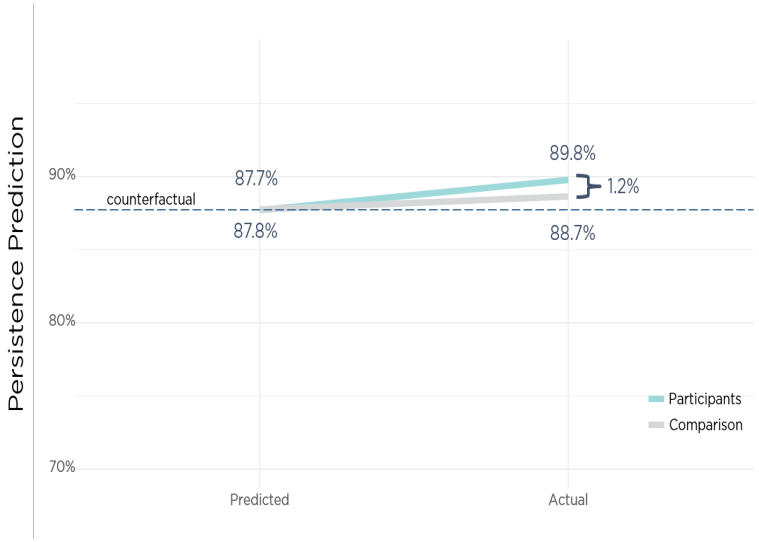


FIGURE 9

Participant and comparison students begin with highly similar persistence predictions. Actual persistence is significantly different between groups.

Does using library resources influence student persistence for STEM majors?

SUMMARY STATISTICS HEADLINE

Overall Change in Persistence: ..... 0.4% (CI: -0.77% to 1.55%)
Overall Change in Students (per term): ..... NA
Analysis Terms: Sp18, Fa18
Students Available for Analysis: ..... 5,576 Students
Percent of Students Participating: 51.2%
Students Matched for Analysis: ..... 3,915 Students
Percent of Students Matched for Analysis 70.2%

STEM PERSISTENCE RATES

Overall, STEM majors have higher predicted persistence scores than non-STEM majors, 87% compared to 84%.

PERSISTENCE & THE LIBRARY RESOURCES FOR STEM MAJORS

An important result from the overall library impact analysis was that STEM students were not experiencing a significant change in persistence from using library resources. This report compared STEM majors who used library resources to STEM majors who did not use library resources. The impact analysis indicated a neutral finding suggesting that STEM students who used library resources were just as likely to persist as STEM students who did not use library resources.

STEM MAJORS AND LIBRARY USE

A minority of students at USU are STEM students, 28.3%. In each of the considered terms, roughly 50% of STEM majors used library resources. Use was highest among students who were more advanced in their program. Students with 4 or more terms completed accounted for 53.2% of library uses, while incoming freshmen accounted for only 13.3% of library uses.

STEM MAJORS AND PERSISTENCE

This group of students also tends to have higher persistence rates than non-STEM students, 87% compared to 84%. After matching, the predicted persistence of matched participating students was 90.1%. Actual persistence of both comparison and participating students increased to about 92%. Since both groups increased in their predicted persistence the change cannot be attributed to library resource use.

PERSISTENCE QUARTILES

Given the higher persistence rates for STEM students, there is less elasticity to make an upward impact on student persistence. However, Illume tools allow us to drill down to students by persistence quartile. Not surprisingly for STEM students, persistence quartile is skewed towards higher persistence scores. In the analysis, 66% of the included students belonged to the top quartiles, indicating a strong likelihood to persist. Of the remaining 34%, only 8.6% belonged to the lowest perdiction quartile.

TAKE-AWAYS

About half of all STEM majors used library resources during the considered semesters. Use was higher for students who are more advanced in their program. Using library resources did not associated with student persistence. The neutral result may have been affected by the already high persistence rates among STEM students and students who are further along in their academic career making it hard to have an impact.

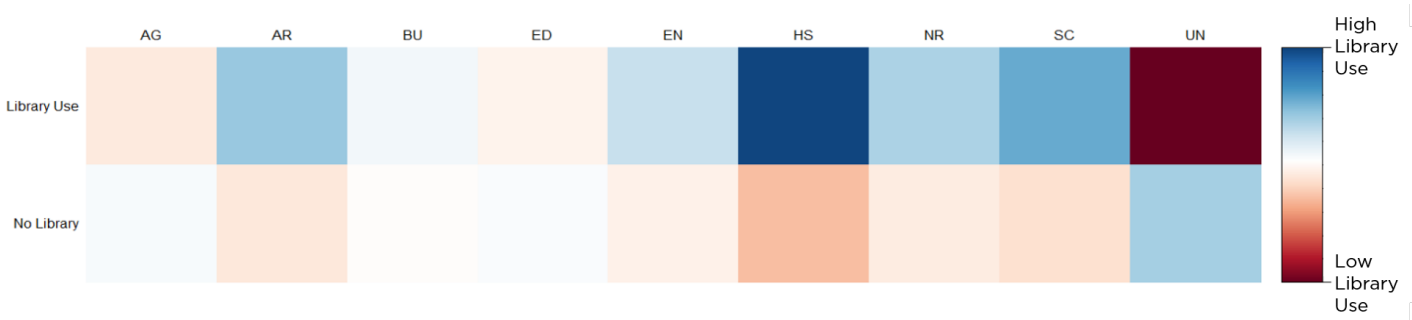


FIGURE 10
Student use of library resources by college.

Which students are using library resources?

COMPARING LIBRARY USE ACROSS COLLEGES

Utah State University dedicates resources to each college to support their use of library materials. This includes having librarians assigned to work with specific colleges and majors to facilitate content-specific support. The extent to which students in each college use library resources was explored in this analysis.

All USU students with access to library resources from the Logan Main Campus library were parsed by their major college. The proportion of students accessing library resources from each college was compared to the expected number of students in a chi squared test of independence. The test revealed statistically significant differences between the expected use and the actual use of library resources between colleges (chi sq. = 1,179.8 (8), $p < .001$). Several colleges used more library resources than expected (Figure 10 dark blue boxes), one college used library resources less than expected (Figure 10 dark red box), and several colleges used resources nearly as much as expected (Figure 10 light blue and red boxes).

HIGH USAGE COLLEGES

The College of Humanities and Social Sciences (HS) used library resources more than expected. While HS accounted for about 10% of students, they accounted for about 20% of library uses during 2018. Other colleges that used library resources more than expected included:

- College of Science (CS)
- College of Art (AR)
- College of Natural Resources (NR)
- College of Engineering (EN)

LOW USAGE COLLEGE

The college designation for students who have not yet declared a major, or for students who have not yet been accepted into a major is UN. Students with this classification use library resources far less than expected. While this college accounted for 27% of students during 2018, they only 13% accessed library resources. The fact that most students in the UN major are early career students likely contributes to the lower use. According to the impact analysis, 50% of library users were upper-classmen and only 13% of users are new freshmen.

Class Rank and Library Use

A chi square test of independence compared library use by class rank (chi sq. = 856.2 (4), $p < .001$). As expected, students in their senior year of college were more likely to use library resources than expected. Juniors also used the library more than expected. Freshmen used the library far less than expected. They account for 30% of students but only 13% of library use.

The impact analysis revealed that new freshment significantly benefit from library use. Currently, the library helped retain 43 (CI: 2 to 82) new freshmen in 2018. If the proportion of freshmen using the library increased to 30%, the library could help retain 99 (CI: 4 to 191) students.

Does using library resources influence student persistence for graduate students?

SUMMARY STATISTICS HEADLINE

Overall Change in Persistence:	2.7% (CI: 0.61% to 4.79%)
Overall Change in Students (per term):	32 (CI: 7 to 57) Students
Analysis Terms:	Sp18, Fa18
Students Available for Analysis:	3,235 Students
Percent of Students Participating:	66.3%
Students Matched for Analysis:	1,193 Students
Percent of Students Matched for Analysis	36.9%

PERSISTENCE & LIBRARY RESOURCES FOR GRADUATE STUDENTS

An important result from the overall library impact analysis was that graduate students experience a significant increase in persistence from using library services. This report compares graduate students who used library resources during a semester to graduate students who did not use library resources. The impact analysis indicated a significant difference in persistence between groups of graduate students who used the library compared to non-users.

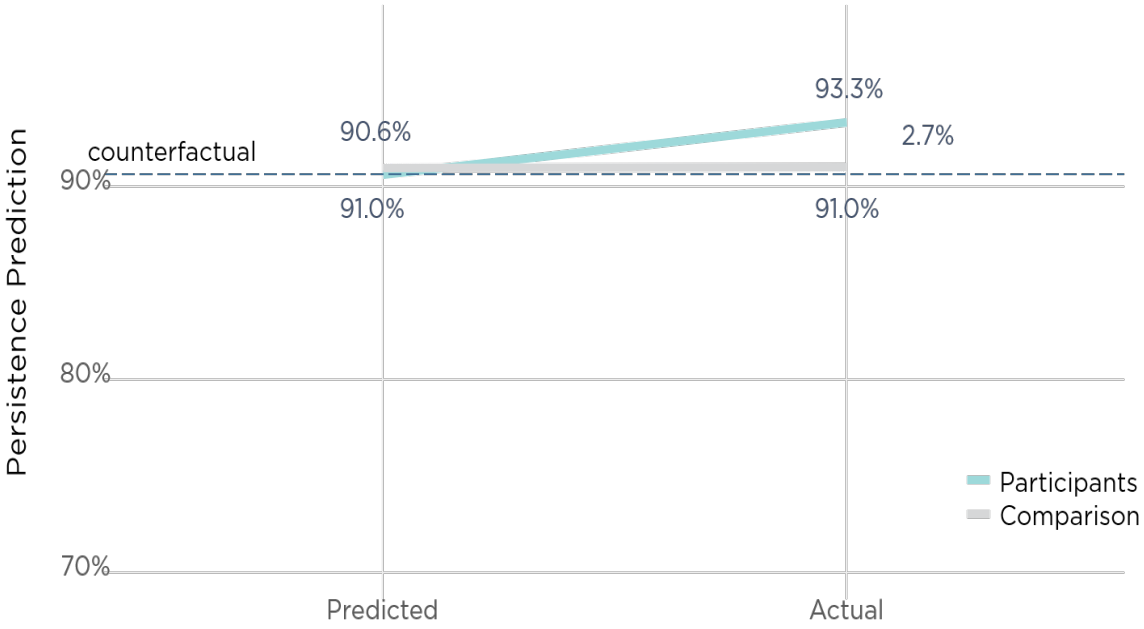


FIGURE 11
Participant and comparison students began with highly similar persistence predictions. Actual persistence was significantly different between groups.

Graduate Students & Using Library Resources

STUDENT IMPACT

Graduate students who used library resources during a semester experienced a significant increase in their persistence to the next term. The estimated increase in persistence was equivalent to retaining 32 (CI: 7 to 57) students who were otherwise not expected to persist. This represents an estimated $152,114.24 (CI: $33,274.99 to $270,953.49) in retained tuition per year, assuming an average graduate tuition of $4,753.57/year.

MATCHING

Matching procedures for this analysis resulted in the inclusion of 36.9% of available participants. This matching number is considered low by methodological standards. However, the low match rate is explained by the proportion of graduate students accesing library resources. Most graduate students use library resources (66.3%) which limited the number of students available for comparison. A close look at the propensity matching curve (Figure 2) shows that the samples of participating and comparison students were fairly similar. A proportion of participating students with high propensity scores were excluded from the analysis. Students with propensity scores less than 0.7 appear to be well represented in the comparison population.

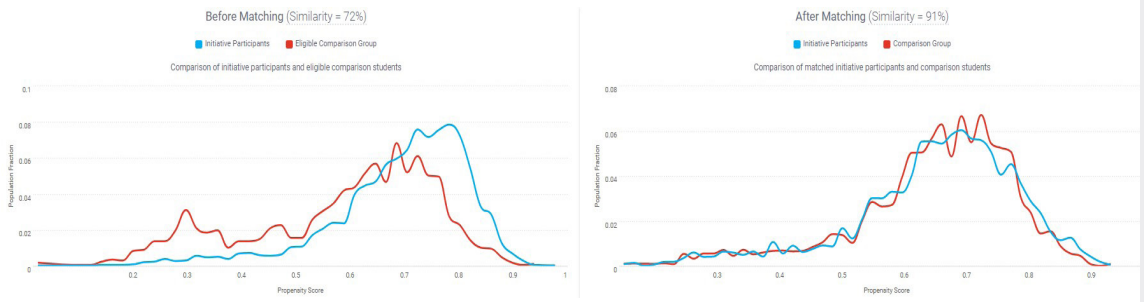


FIGURE 12
Propensity score matching between comparison and participating students. Propensity reflects the likelihood that a student will use the service.

STUDENT DEMOGRAPHICS

Students used in the analysis as participating students (students using library services) were 55.6% male, 88.9% Caucasian, and 3.9% Hispanic/Latino. first-time college students. This is compared to the overall USU graduate students population, where students are 45% male, 78% Caucasian, and 4.9% Hispanic. There were more male and Caucasian students included in the analysis than would be expected from the general graduate student population (Chi squared (male) = 53.9, p > 0.001 ; Chi squared (Caucasian) = 5.8, p = 0.02).

PARTICIPANT

Non-degree seeking students were excluded from the analysis. Participating students had at least 1 record of library service use. Most students (85%) only used one type of service (EZ proxy, check outs, or Book a Librarian). 14.5% of students used 2 library services. The most used library service among graduate students is EZ proxy, followed by check-outs.

Comparison students were graduate students at the Logan and Statewide USU campuses. These students did not have any documented uses of library resources.

Student Segment Findings

INTERESTING SEGMENTS

Several student groups experiences a significant increase in persistence from using library resources. Many of these segments were expected (i.e. graduate students and Caucasians); however, four subgroups are particularly interesting:

- Part-Time Students
- Non-STEM Majors
- Bottom Persistence Quartile Students
- All Online Students

Graduate Student Segment Impact Table

TABLE 3:

Student Segments Experiencing a Significant Change From Participating

N	Student Group	Model Fit	Actual Persistence		Difference in Difference	CI	p-value	Lift in People
			Participants	Comparison Students				
1,193	Overall	Good	93.33%	91.02%	2.70%	2.09%	0.0114	32
1,183	Graduate Students	Good	93.99%	91.74%	2.64%	2.05%	0.0114	31
1,159	Not Hispanic or Latino	Good	93.29%	91.34%	2.35%	2.10%	0.0278	27
965	White or Caucasian	Good	93.50%	90.81%	2.99%	2.33%	0.0122	29
781	Part-time Courses	Good	93.05%	90.37%	2.99%	2.65%	0.0269	23
746	Non-STEM Major	Good	93.59%	89.75%	3.73%	2.90%	0.0115	28
535	1-3 Terms Completed	Good	94.62%	91.29%	3.41%	2.98%	0.0247	18
530	Female Students	Good	93.73%	89.75%	5.11%	3.18%	0.0017	27
265	Bottom Persistence Prediction Quartile (1st - 24th Percentiles)	Good	86.72%	77.22%	9.08%	6.60%	0.0071	24
129*	All Online Status	Good	90.13%	79.47%	11.04%	8.83%	0.0144	14

* Subgroups with fewer than 250 students are considered too small for reliable analysis

Graduate Student Segments with No Change

TABLE 4:
Student Segments Not Experiencing a Significant Change From Participating

N	Student Group	Model Fit	Actual Persistence		Difference in Difference	CI	p-value
			Participants	Comparison Students			
900	All On-Ground Status	Good	93.26%	92.07%	1.65%	2.31%	0.1606
663	Male Students	Good	93.01%	92.08%	0.73%	2.77%	0.6032
506	4+ Terms Completed	Good	92.15%	91.79%	1.17%	3.28%	0.4837
441	STEM Major	Good	93.78%	93.20%	1.55%	3.00%	0.3104
412	Full-time Courses	Good	93.83%	92.34%	1.98%	3.38%	0.2501
343	Second Persistence Prediction Quartile (25th - 49th Percentiles)	Good	91.76%	91.05%	1.14%	4.28%	0.6025
322	Top Persistence Prediction Quartile (75th - 100th Percentiles)	Good	97.89%	97.20%	0.64%	2.42%	0.6027
262	Third Persistence Prediction Quartile (50th - 74th Percentiles)	Good	96.49%	95.35%	1.02%	3.17%	0.5275
164*	Mixed or Blended Status	Adequate	96.42%	94.16%	2.26%	4.65%	0.3403
151*	0 Terms Completed	Poor	92.62%	87.26%	5.44%	6.40%	0.0952
110*	Asian or Asian American	Adequate	96.86%	95.99%	1.81%	4.62%	0.4408
65*	Unknown Racial Heritage	Poor	88.72%	84.80%	2.95%	13.87%	0.6728
34*	Hispanic or Latino	Poor	94.68%	72.37%	20.54%	20.81%	0.0529
23*	Two or More Racial Heritages	Good	90.00%	91.00%	-1.15%	13.95%	0.8685
18*	Black or African American	Poor	87.04%	79.02%	5.08%	23.52%	0.6624
10*	Undergraduate Students	Poor	15.92%	9.24%	7.49%	34.18%	0.6502
9*	First Time in College	Poor	16.70%	8.77%	8.99%	36.56%	0.6084

*Cells with fewer than 250 students are too small for a reliable analysis

**Model fit is estimated by considering the fidelity of the comparison group to the predicted persistence. Good fit is observed when comparison students' actual persistence was similar to their predicted persistence (< 1% difference). Adequate fit has a difference between 1% and 2.9% between actual and predicted persistence. Poor fit has greater than 3% difference between actual and predicted persistence.

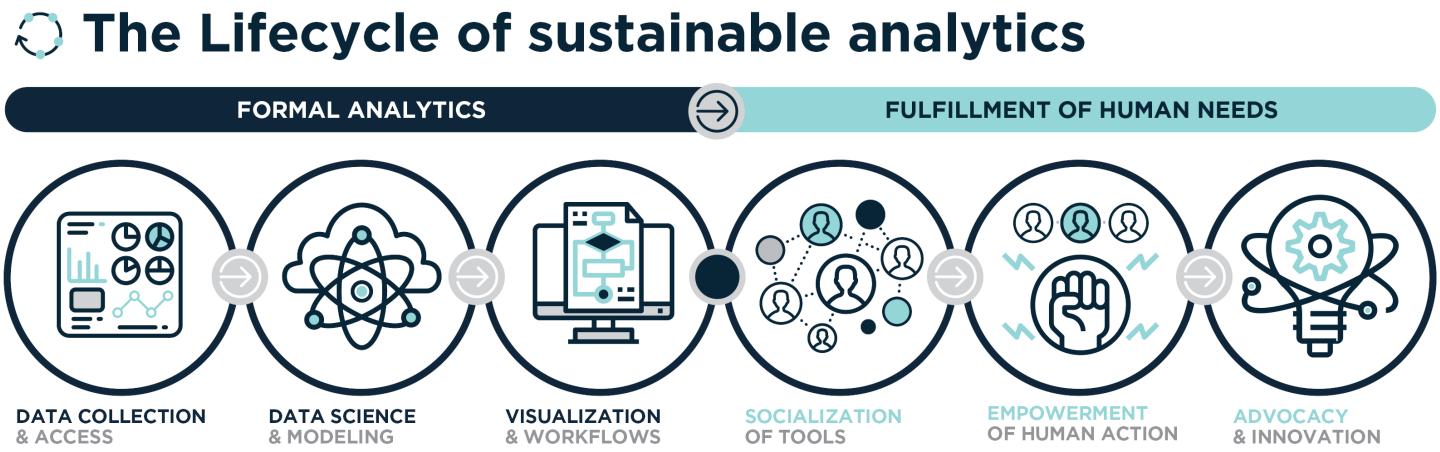


FIGURE 13
The Lifecycle of Sustainable Analytics.

Insights & Next Steps

A major goal of analytics is to identify areas for improvement and innovation. To be successful, all initiatives must consider the role of formal analytics and role of the humans needs. The Lifecycle for Sustainable Analytics presents the major domains within any successful analytics initiatives. It requires sound data science practices on the left-hand and proactive human relations on the right. Together the 6-domains support the development and utilization of analytics insights for improvement and innovation.

Library Insights:

After considering the impacts of Library resources on students, the Library staff added context to the data. In doing this, they were able to find several avenues for continued improvement and innovation.

1. Data Collection Improvements
2. Socialize Insights to Students
3. Socialize Benefits of Analytics to Library Staff
4. Explore Practices within Different Colleges

Expand EZ Proxy Access to Data:

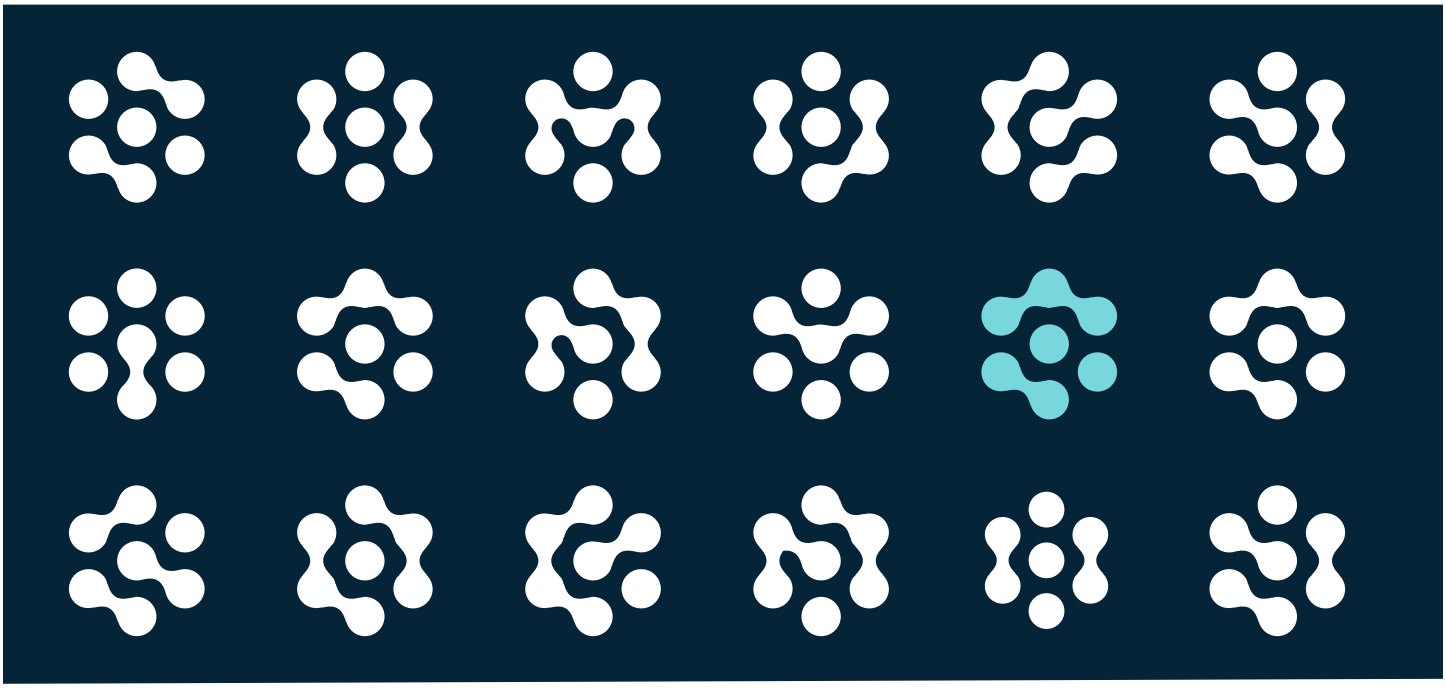
In 2018 the library had 205,558 documented uses of library services; however, this is only a fraction of the actual interactions. Due to the difficulty collecting access information, the EZ Proxy data currently only consists of patrons accessing Library electronic resources from outside a campus IP address. However according to COUNTER statistics, electronic resources are one of the most accessed and most costly materials the Library offers. Without more accurate access data, the Library's ability to identify what impact electronic resources have on the general student population is significantly reduced.

Market the Positive Impacts of Library Use:

Figure 8 indicates the importance of using the Library more than once for persistence implying the positive consequences of students understanding the resources available to them as soon as possible. As such, the Library

Innovations & Improvements

1. Data Collection Improvements
2. Socialize Insights to Students
3. Socialize Benefits of Analytics to Library Staff
4. Empower Quality Interactions
5. Collaborate to Increase First-Year Use



Bradford Cole

Dean of University Libraries, MS & CA

Merrill-Cazier Library

Lindsay Ozburn

Assessment Coordinator, MA, MSLIS

Merrill-Cazier Library

endeavours to introduce students to its resources, services, and spaces as early as possible in their educational journey. Marketing this analysis can help increase participation in current Library programs aimed at early undergraduates.

Socialize Analytics with Library Staff:

There is confusion and uncertainty amongst Library staff about the learning analytics process, including data collection and security. As staunch supporters of data privacy and protection, Library staff are interested in learning more about the learning analytics process. The Library endeavours to continue dialogue on this topic between staff and campus entities to ensure transparency and understanding.

Empower Quality Interactions with Library Resources for STEM Majors:

While the analysis identified the positive impact the Library has on many populations, the analysis indicates that STEM students did not experience the same gains as non-STEM students. Further analysis showed that STEM majors are using Library resources. The Library intends to focus on the quality of library resources interactions for STEM students to improve the impact on that group of students.

Collaborate to Increase First-Year Student Use of Library Resources:

Using Library resources impacts new freshmen (0 terms completed) and early career students (1 - 3 terms completed). Yet, we saw that new students are using the library less than expected. The Library collaborate with other University entities interested in impacting the first-year experience to increase use of Library resources. It is expected that the Library can support student in retention efforts at USU.

References

Astin, A. (1993). What Matters in College? Jossey-Bass. San Francisco, CA.

Baer, L. L., Kil, D., & Hagman, A. M. (2019). Sherlock Holmes redux: Putting the pieces together. In L. L. Baer & C. Carmean (Eds.), An analytics handbook: Moving from evidence to impact (pp. 39-50). Ann Arbor, MI: Society for College and University Planning.

Baer, L., Hagman, A. M., Kil, D. (2020). Preventing the winter of disillusionment. Educause Review. 1: 46-54.

Kuh, G. D. & Goyea, R. M. (2003). The role of academic library in promoting student engagement in learning. College and Research Libraries, 64(4): 256-282.

Geneletti, S. & Dawid, A. P. (2009) Defining and identifying the effect of treatment on the treated. In Illari, P. M., Russo, F., & Williamson, J. (Eds.). Causality in the Sciences. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199574131.003.0034

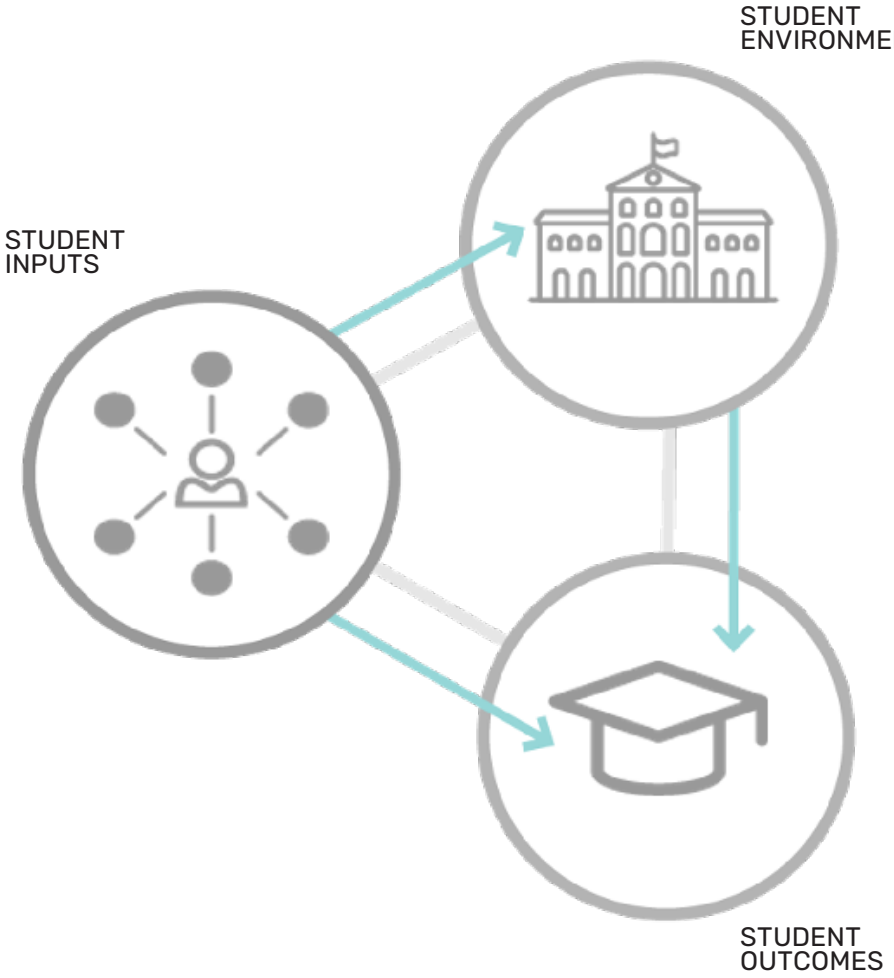
Louviere, J. (2020). Persistence impacts on student subgroups that participate in the high impact practice of service learning. All Graduate These and Dissertations. 7746. https://digitalcommons.usu.edu/etd/7746

Milliron, M., Kil, D., Malcolm, L., Gee, G. 2017. From innovation to impact: How higher education can evaluate innovation's impact and more precisely scale student support. Planning for Higher Education Journal, 45(4), 1-12.

Rosenbaum, P.R. & Rubin (1983). The central role of the propensity socre in observational studies for causal effects. Biometrika, 70(1), 41-55.

Appendix A

THEORETICAL FOUNDATION FOR IMPACT ANALYSES: INPUT, ENVIRONMENT, OUTPUT MODEL (ASTIN , 1993)



Input - Environment - Outcomes

Student success is composed of both personal inputs and environments to which individuals are exposed (Astin, 1969). Impact analysis controls for student input though participant matching on (1) their likelihood to be involved in an environment and (2) their predicted persistence score. By controlling for student inputs, impact analyses can more accurately measure the influence of specific student environments on student persistence.

STUDENT INPUTS

Students bring different combinations of strengths to their university experience. Their inputs influence student life and success, but do not determine it.

STUDENT ENVIRONMENTS

The University provides a diverse array of curricular, co-curricular, and extra-curricular activities to enhance the student experience. Students selectively participate to varying degrees in activities. Student environments influence student life and success, but do not determine it.

STUDENT OUTCOMES

While student success can be defined in multiple ways, a good indicator of student success is persistence to the next term. It means that students are continuing on a path towards graduation. Persistence is influenced by student inputs and University environments.

IMPACT ANALYSIS

An impact analysis can effectively measure the influence of University initiatives on student persistence by accounting for student inputs through matching participants with similar students who chose not to participate.

Appendix B

ANALYTIC DETAILS: ESTIMATING PROGRAMMATIC IMPACT THROUGH PREDICTION-BASED PROPENSITY SCORE MATCHING (PPSM)

Impact analyses are quasi-experiments that compare students who participate in University initiatives to similar students who do not. Students who participate are called participants, students who do not have a record of participation are called comparison students. The analysis results in an estimation of the effect of the treatment on the treated (ETT). In other words, it estimates the effect of participating in University initiatives on student persistence for students who participated. This estimation is appropriate for observational studies with voluntary participation (Geneletti & Dawid, 2009).

Accounting for bias. While ETT is appropriate for observational studies with voluntary participation, voluntary participation adds bias. Specifically, voluntary participation results in self-selection bias, which refers to the fact that participants and comparison students may be innately different. For example, students who self-select into math tutoring (or intramerals or the Harry Potter Club) may be quantitatively and qualitatively different than students who do not use math tutoring (or intramerals or the Harry Potter Club). To account for these differences, reduce the effect of self-selection bias, and increase validity, a matching technique called Prediction-Based Propensity Score Matching (PPSM) is used.

In PPSM, matching is acheived by pairing participating students with non-participating students who are similar in both their (a) predicted persistence and (b) their propensity to participate in an iterative, boot-strapped analysis (Milliron, Kil, Malcolm, & Gee, 2017).

(A) Predicted Persistence. Utah State University utilizes student data to create a persistence prediction for each student. The main benefit to students from the predictive system is an as early alert system; it identifies students in need of additional resources to support their success at USU. A secondary use of the predicted persistence scores are to evaluate the impact on student-facing programs on student success. This is an invaluable practice that fosters accountability, efficiency, and innovation for the benefit of students.

The predicted persistence scores are derived through a regularized ridge regression. This technique allows for the incorporation of numberous student data points, including:

- academic performance
- degree progress
- socioeconomic indicators
- student engagement

The ridge regression rank orders the numerous covariates by their predictive power. This equation is then used to predict student persistence scores for students at USU. This score is utilized as one point for matching in PPSM.

(B) Propensity to Participate. The second point used for matching in PPSM is a propensity score. Propensity scores reflect a students likelihood to participate in an initiative (Rosenbaum & Rubin, 1983). It is derived through logistic ridge regression that utilizes participation status as the outcome variable. Using the equation, each student is given a propensity score which reflects thier likelihood to participate regardless of their actual participation status.

Matching is achieved through bootstrapped iterations that randomly selects a subset of participant and comparison students. Within each bootstrapped iteration, comparison students are paired using 1-to-1, nearest neighbor matching. Matches are created when student predicted persistence and propensity scores match within a 0.05 caliper width. Within the random bootstrapping iterations, all participants are included at least once. Students who do not find an adequate match are excluded from the analysis (for additional details see Louviere, 2020).

DIfference-in-Difference. To measure the impact of University services on student persistence, a difference-in-difference analysis is used. A difference-in-difference analysis compares the calculated predicted means from the bootstrapped iteration distributions to the actual persistence rates of participating and comparison students. In other words, the analysis looks at the difference between predicted persistence and actual persistence between the two groups of well-matched students.

Appendix C

ADJUSTED RETAINED TUITION MULTIPLIER

Retained tuition is calculated by multiplying retained students by the USU average adjusted tuition. Average adjusted tuition was calculated in 2018/2019 dollars with support from the Budget and Planning Office. The amounts in the below table reflect net tuition which removes all tuition waivers from the overall gross tuition amounts. Utilizing net tuition provides a more accurate and conservative multiplier for understanding the impact of University initiatives on retained tuition. The table below parses the average adjusted tuition by campus and academic level. The highlighted cell represents the multiplier used in this analysis.

RETAINED TUITION MULTIPLIER CALCULATION

Student Groups	Net Tuition	Number of Students	Average Annual Tuition & Fees
All USU Students	$148,864,384	33,070	$4,501.49
Undergraduates	$131,932,035	29,033	$4,544.21
Graduates	$16,932,349	4,037	$4,194.29
Logan Campus Students	$119,051,003	25,106	$4,741.93
Undergraduates	$107,711,149	22,659	$4,753.57
Graduates	$11,339,854	2,447	$4,634.19
Statewide Campus Students	$25,941,419	7,964	$3,257.34
Undergraduates	$20,303,215	3,864	$5,254.46
Graduates	$5,638,204	1,590	$3,546.04
USU-E Price & Blanding Students	$3,871,962	2,560	$1,512.49

Appendix D

STUDENT SEGMENTS THAT DID NOT EXPERIENCE A SIGNICIANT CHANGE IN PERSISTENCE

		Actual Persistence				
N	**Student Group**	**Participants**	**Comparison Students**	**Difference-in**	**CI**	**p-value**
7,998	4+ Terms Completed	91.04%	90.20%	0.62%	0.87%	.16
4,076	Third Persistence Prediction Quartile (50th - 74th Percentiles)	94.10%	93.19%	0.99%	1.05%	.07
3,938	Top Persistence Prediction Quartile (75th - 100th Percentiles)	96.73%	96.42%	0.29%	0.80%	.48
3,843	STEM Major	91.45%	91.26%	0.65%	1.14%	.27
3,056	Readmitted Students	86.93%	85.64%	1.45%	1.65%	.09
1,416	Graduate Students	91.93%	90.77%	1.55%	2.01%	.13
510	Unknown Racial Heritage	86.08%	83.32%	1.73%	4.29%	.43
455	Two or More Racial Heritages	88.52%	87.91%	-0.36%	4.08%	.86
382	American Indian/Alaskan Native	74.21%	70.98%	3.93%	6.97%	.27
361	Hispanic or Latino	87.01%	82.43%	2.74%	5.26%	.31
298	Asian or Asian American	90.38%	91.82%	0.08%	4.11%	.97
245*	High School Dual Enrollment	48.96%	49.16%	-1.25%	8.17%	.76
155*	Black or African American	89.13%	83.16%	3.77%	7.35%	.31
117*	Unknown Undergraduate Type	63.68%	51.27%	9.09%	11.28%	.11
45*	Pacific Islander	87.11%	89.54%	0.25%	11.07%	.96

*Cells with fewer than 250 students are too small for reliable analysis

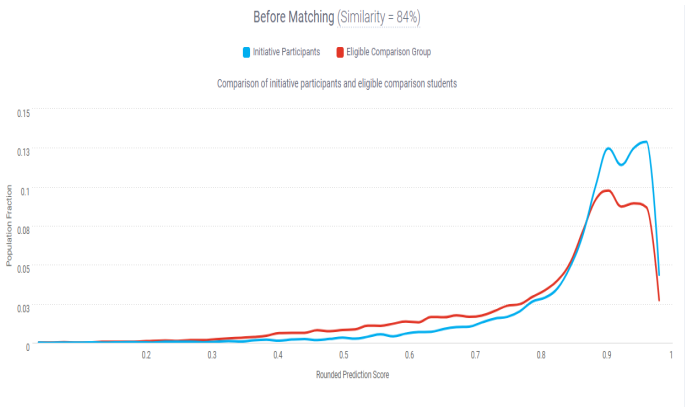
Appendix E

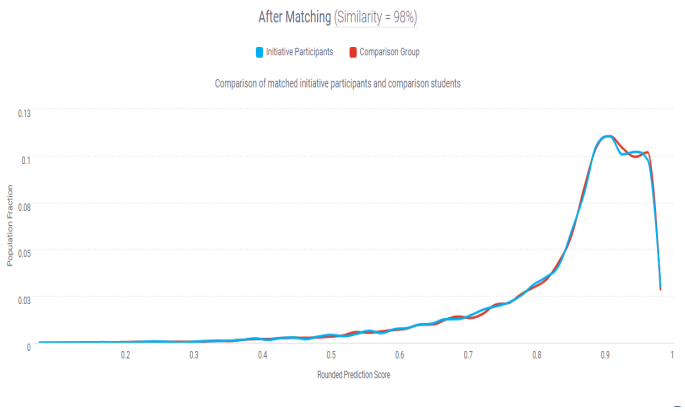
MATCHING DETAILS

Matching for the analysis resulted in 61% of available participants, or 16,092 students, being successfully matched for the analysis. Participating students who did not have an adequate match in the comparison group during the PPSM process were excluded from the analysis. While higher matching is preferred, a 61% match is adequate with a large sample size, like those seen in this analysis. Furthermore, upon reviewing the matching distributions for predicted persistence (Figure A) and and propensi-ty to participate (Figure B) showed significant overlap. This indicates that a representative sample of participating students were included in the analysis.

Prior to matching samples were 84% similar based on students' predicted persistence (Figure A). Following matching the samples were 98% similar.

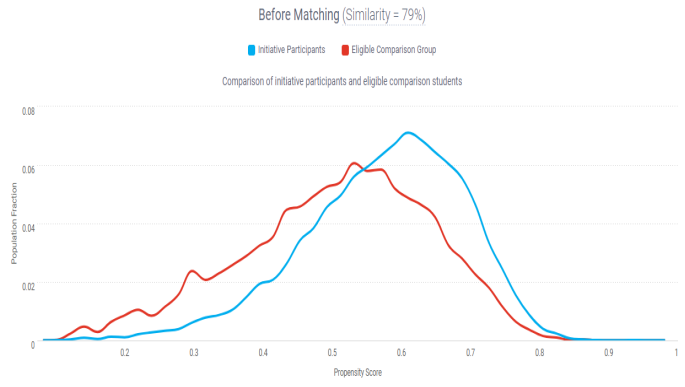
Participating and comparison students were 79% similar based on propensity score prior to matching. Following matching, the similarity in propensity score range was 98% to 99%.

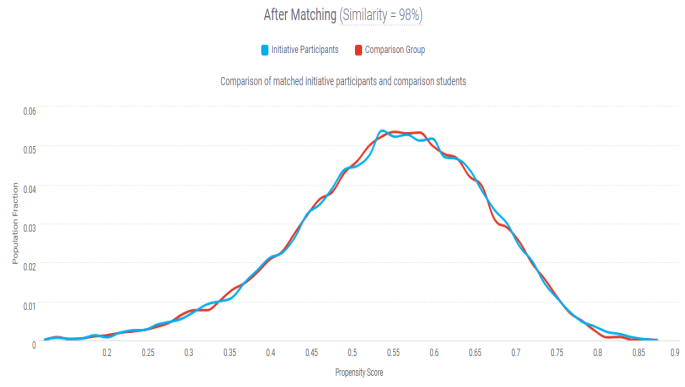




PREDICTED PERSISTENCE: PARTICIPATING & COMPARISON STUDENTS

Participating and comparison students receive scores based on their predicted persistence to the next semester.





PROPENSITY TO PARTICIPATE BTW PARTICIPATING & COMPARISON STUDENTS

Participating and comparison students receive scores based on their likelihood to participate in the initiative.

Appendix F

STUDENT SEGMENT DEFINITIONS

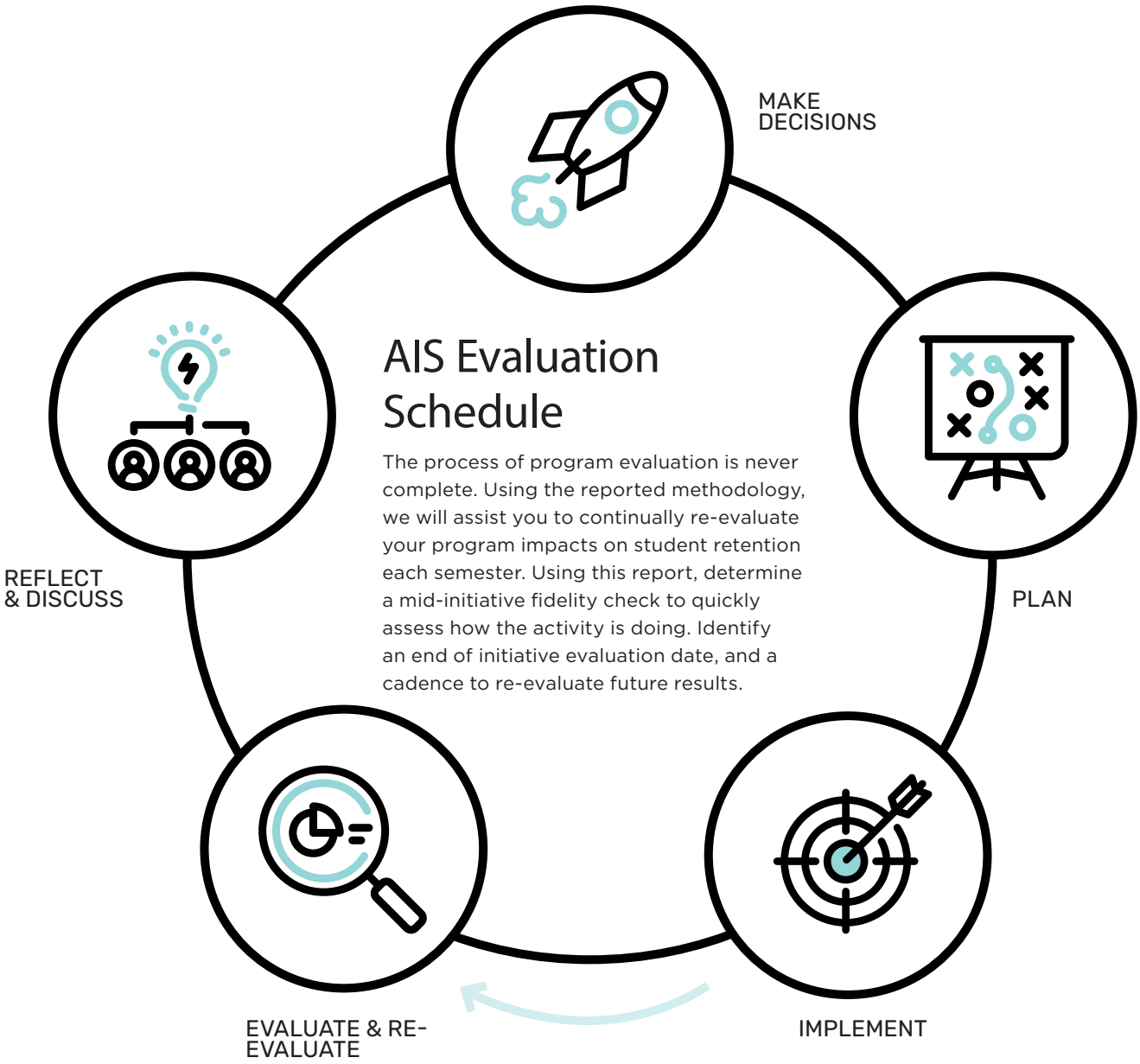
Student Subgroup	Definition
0 Terms Completed	Students with 0 terms in their collegiate career completed; incoming freshmen
1 - 3 Terms Completed	Students who have completed 1 to 3 terms in their collegiate career
4+ Terms Completed	Students with 4 or more terms in their collegiate career completed
All On-Campus	Students attending all courses face-to-face
Online or Broadcast	Students attending all courses online or via broadcast
Mixed or Blended Course Modality	Students attending both face-to-face and online or broadcast courses
Full-time Students	Undergraduate students enrolled in 12 or more credits; Graduate students enrolled in 9 or more credits
Part-time Students	Undergraduate students enrolled in less than 12 credits; Graduate students enrolled in less than 9 credits
First Time in College	Students who enter USU as new freshmen, who have maintained continuous enrollment or records of absences (i.e. LOA)
Transfer Students	Students who attended another university prior to attending USU
Readmitted Students	Students who attended USU, left for a time (without filing a LOA), and returned after re-applying to USU
Unknown Undergraduate Type	Students with an unknown admitted type
High School Dual Enrollment	High school students simultaneously taking high school and college courses
STEM	Students with a primary major in science, technology, engineering, or mathematics
Non-STEM	Students with a primary major that is not in science, technology, engineering, or mathematics
Top Persistence Prediction Quartile	The total USU student population is divided so that 25% of students fall in each quartile. The top quartile contains students with the highest predicted persistence (75th – 100th percentile)
Third Persistence Prediction Quartile	The total USU student population is divided so that 25% of students fall in each quartile. The thrid quartile contains students with higher predicted persistence (50th – 74th percentiles)
Second Persistence Quartile	The total USU student population is divided so that 25% of students fall in each quartile. The second quartile contains students with lower predicted persistence (25th – 49th percentiles)
Bottom Persistence Quartile	The total USU student population is divided so that 25% of students fall in each quartile. The bottom quartile contains students with the lowest predicted persistence (1st – 24th percentile students)
Female	Students identifying as female
Male	Students identifying as male

STUDENT SEGMENT DEFINITIONS [CONTINUED]

Student Subgroup	Definition
Non-Hispanic or Latino	Students who do not identify as Hispanic or Latino
Hispanic or Latino	Students who identify as Hispanic or Latino
Race: Two or More	Students who identify with two or more races
Race: Unknown	Students who did not provide race information
Race: Asian	Students who identify as Asian
Race: Black or African American	Students who identify as African American
Race: Pacific Islander	Students who identify as a Pacific Islander
Race: American Indian/ Alaskan Native	Students who identify as American Indian or Alaska Native
Race: White or Caucasian	Students who identify as White or Caucasian

Appendix G

UTAH STATE UNIVERSITY'S EVALUATION CYCLE



EVALUATE & RE-EVALUATE

Get the data to AIS and we can run an evaluation on persistence. For goals that don't include persistence AIS can assist you in finding resources to measure your improvement.

REFLECT & DISCUSS

Consider the report and the evaluator insights to produce discussion within your department.

MAKE DECISIONS

Formulate possible actions to improve your program. Select actions that align with your program goals.

PLAN

Make concrete plans to apply your decisions. Determine the who, where, and when of your actions.

IMPLEMENT

Put your plans into actions. Remember to periodically check the progress of your plans as they are being implemented.