This report provides a multi-institutional analysis to examine the impact of information literacy instruction on first-year students’ academic success across 17 campuses in the California State University System.

COLD Student Success Study Report

December 2020

Table of Contents

[Project Summary 4](#_Toc57993680)

[Part I. 1. Introduction 5](#_Toc57993681)

[Part I. 2. Research Design 6](#_Toc57993682)

[Part I. 3. Results 8](#_Toc57993683)

[Part I. 3. 1. Students and IL Instruction - Overview 8](#_Toc57993684)

[Part I. 3. 2. Effect of IL instruction on Students’ Academic Success 12](#_Toc57993685)

[Part I. 3. 3. Effect of Teach Method on Students’ Academic Success 14](#_Toc57993686)

[Part I. 3. 4. Effect of IL Instruction Characteristic on Students’ Academic Success 18](#_Toc57993687)

[Part I. 4. Conclusion 23](#_Toc57993688)

[References 24](#_Toc57993689)

[Part II. 1. Original Plan for Data Collection 26](#_Toc57993690)

[Part II. 1. 1. Original Data Collection Plan – Key Variables 26](#_Toc57993691)

[Part II. 1. 2. Original Data Collection Plan – Data Sources and Additional Variables 28](#_Toc57993692)

[Part II. 2. Data Collection Procedures 29](#_Toc57993693)

[Part II. 3. The COVID-19 Pandemic and Data Collection Adjustments 32](#_Toc57993694)

[Part II. 4. Data Collection Issues 32](#_Toc57993695)

[Part II. 5. Conclusion 33](#_Toc57993696)

[Part III. 1. Introduction 34](#_Toc57993697)

[Part III. 2. Results 35](#_Toc57993698)

[Part III. 3. Conclusion 49](#_Toc57993699)

List of Figures

[Figure 1. Sample data output for students’ GPA, earned credits and demographic information using hypothetical data 30](#_Toc57991132)

[Figure 2. Sample data output for students’ course data using hypothetical data 30](#_Toc57991133)

[Figure 3. Sample data output for IL instruction data using hypothetical data 31](#_Toc57991134)

[Figure 4. Sample data collection form for IL instruction data 31](#_Toc57991135)

[Figure 5. Number of courses for which IL instruction was provided in fall 2019 and spring 2020 36](#_Toc57991136)

[Figure 6. Average of IL instruction duration for a course (measured in minutes) 37](#_Toc57991137)

[Figure 7. Percentage of courses that received IL instruction entirely or partially in the online format 38](#_Toc57991138)

[Figure 8. Percentage of courses where the “Lecture” method was used IL instruction 40](#_Toc57991139)

[Figure 9. Percentage of courses where the “Flipped classroom” method was used IL instruction 41](#_Toc57991140)

[Figure 10. Percentage of courses where the “Directed practice” method was used IL instruction 42](#_Toc57991141)

[Figure 11. Percentage of courses where the “Active learning” method was used IL instruction 43](#_Toc57991142)

[Figure 12. Percentage of courses where the IL instruction was integrated into the course 44](#_Toc57991143)

[Figure 13. Percentage of courses where “Online tutorials or digital learning objects” was integrated in IL instruction 45](#_Toc57991144)

[Figure 14. Percentage of courses where a research guide (or a tab on a research guide) is developed or customized specifically for the course 46](#_Toc57991145)

[Figure 15. Percentage of courses where the IL librarian was involved in course design 47](#_Toc57991146)

[Figure 16. Percentage of courses where the IL librarian was involved in assignment design 48](#_Toc57991147)

[Figure 17. Percentage of courses where a library tour was provided 49](#_Toc57991148)

List of Tables

[Table 1. Students’ ethnicity 8](#_Toc57991198)

[Table 2. Students’ gender 9](#_Toc57991199)

[Table 3. Students’ birth year 9](#_Toc57991200)

[Table 4. Percentage of students enrolled in different number of courses with IL Instruction 10](#_Toc57991201)

[Table 5. Percentage of courses with IL instruction taken by 2019-2020 first-year students 11](#_Toc57991202)

[Table 6. Percentage of students in terms of number of one-shot sessions, instruction format, instruction provider, and average duration of instruction for the IL instruction they received 12](#_Toc57991203)

[Table 7. Impact of IL instruction on students’ GPA and earned credits respectively 13](#_Toc57991204)

[Table 8. Impact of IL instruction on students’ GPA and earned credits combined 14](#_Toc57991205)

[Table 9. Percentage of students in terms of the teaching methods used in the IL instruction they received 14](#_Toc57991206)

[Table 10. Impact of the “Lecture” method on students’ GPA and earned credits respectively 15](#_Toc57991207)

[Table 11. Impact of the “Flipped Classroom” method on students’ GPA and earned credits respectively 16](#_Toc57991208)

[Table 12. Impact of the “Directed Practice” method on students’ GPA and earned credits respectively 16](#_Toc57991209)

[Table 13. Impact of the “Active Learning” method on students’ GPA and earned credits respectively 17](#_Toc57991210)

[Table 14. Impact of each teaching method on students’ GPA and earned credits combined 18](#_Toc57991211)

[Table 15. Percentage of students in terms of the characteristics of the IL instruction they received 18](#_Toc57991212)

[Table 16. Impact of “Course Integration” on students’ GPA and earned credits respectively 19](#_Toc57991213)

[Table 17. Impact of “Online Tutorial or Digital Learning Object” on students’ GPA and earned credits respectively 20](#_Toc57991214)

[Table 18. Impact of “Research Guide” on students’ GPA and earned credits respectively 21](#_Toc57991215)

[Table 19. Impact of “Librarian Involvement in Course Design” on students’ GPA and earned credits respectively 21](#_Toc57991216)

[Table 20. Impact of “Librarian Involvement in Assignment Design” on students’ GPA and earned credits respectively 22](#_Toc57991217)

[Table 21. Impact of “Library Tour” on students’ GPA and earned credits respectively 23](#_Toc57991218)

[Table 22. Impact of each IL instruction characteristic on students’ GPA and earned credits combined 23](#_Toc57991219)

[Table 23. Percentage of courses that received different number of one-shot sessions in IL instruction 37](#_Toc57991220)

[Table 24. Percentage of courses that received different formats of IL instruction 38](#_Toc57991221)

[Table 25. Percentage of courses that received IL instruction from people in different roles 39](#_Toc57991222)

# Project Summary

This project, titled “*The Council of Library Deans (COLD) Student Success Study*”, was a multi-institutional study to examine the impact of IL instruction on 2019-2020 first-year students’ academic success and retention across seventeen campuses within the California State University (CSU) system.

In **Part I** of the report, we present project findings to answer the following research questions:

* What effect does IL instruction have on students’ academic success?
* What effect does a specific teaching method/characteristic used in IL instruction have on students’ academic success?

About 29% of the 2019-2020 first-year students in all participating campuses took courses in fall 2019 (and summer 2019 if applicable) where IL instruction was provided. Overall, the effect of IL instruction on students’ academic success, measured in their earned credits and GPA, was negligible. As for the specific teaching methods and characteristics used in the IL instruction, some had positive effects and some had negative effects on students’ earned credits and GPA, and the effect size was mostly small to negligible. Among the individual institutions that participated in the project, there was notable variation in terms of the direction and size of the effect of IL instruction or the teaching methods/characteristics on students’ earned credits or GPA. Still, there was no statistically significant effect size that would be considered large. In other words, the study did not detect a strong positive effect of IL instruction on students’ academic success. It was necessary to consider the limitations we faced given COVID-19’s disruptions. We believe this analysis can still serve as a baseline for comparative and longitudinal studies in the future.

**Part II** of the report provides a detailed explanation of the methodology employed in this project, especially how the COVID-19 had disrupted our original data collection plan and how we made adjustments for the study to proceed.

In **Part III** of the report, we offer a comparative view of each participating institution’s IL instruction activities in fall 2019 and spring 2020. Overall there had been a decrease in the total number of courses that received synchronous real-time IL instruction from fall 2019 to spring 2020, but an increase in the percentage of courses where the IL instruction was delivered entirely or partially online, as a likely result of pandemic-induced adjustments. This analysis may serve as a starting point to generate more conversations about IL instruction across institutions and encourage further explorations of the teaching methods and IL instruction characteristics where notable differences exist between institutions.

Despite the multitude of challenges posed by the pandemic, all the participating institutions were always supportive in the data collection process. Their remarkable partnership is essential to the successful completion of this project.

Part I. A Multi-Institutional Analysis of Information Literacy Instruction’s Impact on First-Year Student Success

# Part I. 1. Introduction

Academic Libraries are an important factor of student success. The resources and services provided by academic libraries (1) make college more affordable (Todorinova & Wilkinson, 2019), (2) increase persistence and retention (Stone, Pattern & Ramsden, 2012; Haddow, 2013; Soria, Fransen & Nackerrud, 2013,2014; Eng & Stadler, 2015; Stemmer & Mahan, 2016), and (3) improve graduation rates while reducing time to graduation (Soria, Fransen, & Nackerrud, 2017).

A major responsibility of academic librarians is to provide information literacy (IL) instruction to college students. Librarians and educators are motivated to examine the impact of IL instruction on student learning. One such research effort was organized by the Greater Western Library Alliance (GWLA). Their study sought to evaluate and quantify IL instruction’s impact on first-year students’ academic success and retention rates, and provide actionable findings for libraries and their IL instruction programs. In their project report titled “*The Impact of IL instruction on Student Success: A Multi-Institutional Investigation and Analysis*” (GWLA, 2017), they pointed out that information literacy is essential to creating life-long learners, world citizens, critical thinkers and producers of new knowledge. The ability to find, evaluate, and use information efficiently and effectively is critical in the information and technology saturated society. Thus, “a need to holistically evaluate the impact of all types of information literacy/library instruction across all types of institutions in different geographic locations and disciplines is warranted” (GWLA, 2017). Yet, existing research aiming to illustrate the significant benefits of information literacy instruction tends to be primarily case studies. To mitigate this inadequacy, GWLA implemented a multi-institutional study involving 12 participating campuses, who were all members of GWLA. Their findings indicated that student retention rates are higher for those students whose courses include an IL instruction component, and first-Year GPA for students whose courses included IL instruction was higher than the GPA of students whose courses did not.

*In 2015, The California State University launched an important intitative to be graduating, on average, 40% of first-year students within 4 years, and 70% within 6 years by 2025. Recognizing the potential impact of library instruction on student success, we decided to replicate the GWLA study within the CSU.*Our project was titled “*The Council of Library Deans (COLD) Student Success Study*”, as it was sponsored by the CSU Council of Library Deans (COLD). The following CSU campuses participated in the study:

* California State University, Bakersfield
* California State University Channel Islands
* California State University, Chico
* California State University, East Bay
* California State University, Fresno
* Humboldt State University
* California State University, Long Beach
* California State University Maritime Academy
* California State University, Monterey Bay
* California State University, Northridge
* California State Polytechnic University, Pomona
* California State University, Sacramento
* California State University, San Bernardino
* San Diego State University
* San Francisco State University
* San José State University
* Sonoma State University

Originally, we had planned to collect data about the 2019-2020 first-year student group across all participating CSU institutions in both fall 2019 and spring 2020, to answer the same research questions in the GWLA study:

* What effect does IL instruction have on student retention?
* What effect does a specific teaching method/characteristic used in IL instruction have on student retention?
* What effect does IL instruction have on students’ academic success?
* What effect does a specific teaching method/characteristic used in IL instruction have on students’ academic success?

Unfortunately, the COVID-19 pandemic broke out in the middle of spring 2020, introducing a multitude of confounding variables that would taint the validity of student data collected in spring 2020 as well as the 2019-2020 year-to-year retention data. Thus, we had to adjust our strategies and exclude both the spring 2020 student data and the retention data from the study, and only examined the fall 2019 student data to answer the revised research questions:

* **What effect does IL instruction have on students’ academic success?**
* **What effect does a specific teaching method/characteristic used in IL instruction have on students’ academic success?**

Still, we believe that as a multi-institutional research project to evaluate the impact of first-year IL instruction on student success, our study can help inform the best practices for IL instruction activities and enhance instructional efforts for student success across diverse campuses. Findings of our study not only identify the effectiveness of specific teaching methods/characteristics, providing insights for strengthening IL instruction pedagogy; but also advance professional knowledge of the role of IL instruction in particular, and that of academic library/librarians in general in supporting student success. Through the collaborative effort in investigating IL instruction’s value, our study will enable more conversations across institutions regarding how libraries can improve IL instruction to help students successfully engage in their academic pursuits.

# Part I. 2. Research Design

There are four sets of key variables in our research questions, as underlined below:

* **What effect does IL instruction have on students’ academic success?**
* **What effect does a specific teaching method/characteristic used in IL instruction have on students’ academic success?**

The operational definitions for these variables are as follows:

**IL instruction**: whether or not a 2019-2020 first-year student took a course where IL instruction was provided in fall 2019 (if the student enrolled as a summer-bridge student, meaning that the student started their first semester in summer 2019, their courses in summer 2019 were also examined regarding whether or not IL instruction was provided for those courses). IL instruction was defined as IL instructional activities that were provided synchronously in real time for a credit-bearing course listed in the course catalog. If the IL instruction was delivered asynchronously (e.g. via pre-recorded video lectures), or for non-credit-bearing workshops/events, it would not meet the eligibility criteria for data collection and thus was excluded from the study.

**Students’ academic success**: the academic success of the 2019-2020 first-year students was measured by two indicators – their GPA in fall 2019, and the number of credits they earned in fall 2019.

**A specific teaching method:** whether or not a particular teaching method was used in the IL instruction that was provided for a course taken by a 2019-2020 first-year student. Four teaching methods were examined (we used the same definitions as in the GWLA study):

* + **Lecture,** defined as "a presentation and/or demonstration, with or without the help of projection of the active website, power-point slides, handouts, etc., with students listening/watching but not actively practicing the methods".
  + **Flipped classroom,** defined as " students were assigned material to complete in advance (modules, videos, tutorials, assignments, etc.), then followed by library instruction which covers the material in greater depth or covers other additional material".
  + **Directed practice,** defined as "as librarian provided demonstrations, students followed along step-by-step on their computers, e.g. using certain search terms and strategies suggested by the librarian".
  + **Active learning**, defined as "students worked in groups or individually to complete in-depth activities and tasks assigned by the librarian; this differs from directed practice in that students complete the tasks independently instead of following the demonstrations step by step".

**A specific IL instruction characteristic:** whether or not a particular IL instruction characteristic was used in the IL instruction that was provided for a course taken by a 2019-2020 first-year student. Six IL instruction characteristics were examined (we used the same definitions as in the GWLA study):

* + **IL instruction is integrated into the course -** the instruction is specifically designed for the course, instead of being more of a general introduction of library resources/services that is independent of the course objectives/content.
  + **Online tutorials or digital learning objects are integrated as assignment(s) or assessment(s), or used interactively during the instruction** (e.g. students completing the tutorials as part of an in-class activity)
  + **A research guide (or a tab on a research guide) is developed or customized specifically for the course** – this is different from using a pre-existing research guide (or a tab on a research guide) on relevant topics but not purposefully developed or customized for the course.
  + **The IL librarian collaborates with the course instructor in designing the course.**
  + **The IL librarian collaborates with the course instructor to develop at least one credit-bearing assignment for the course.**
  + **An organized class tour of library facilities is provided for the course.**

Based on these definitions, IL instruction data and anonymized student data were collected respectively from each participating campus’s library and their Office of Institutional Research. Part II of this report explains in detail the data collection process we followed in this study.

# Part I. 3. Results

## Part I. 3. 1. Students and IL Instruction - Overview

Across all the participating CSU campuses, a total of 45931 students of the 2019-2020 first-year student group were included in the study. Their demographic data in fall 2019 was collected and Tables 1, 2 and 3 provide a break-down of their ethnicity, gender and age. *Empty cells indicate that there were no students in that category for a participating institution*. The names of the participating CSU campuses were anonymized for privacy concerns. Much variation existed across the different participating institutions.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | American Indian or Alaska Native | Asian | Black or African American | Hispanic or Latino | Native Hawaiian or Other Pacific Islander | White or Caucasian | Two or More Races | Unknown/Other Races or Non-resident Alien | Total Population |
| All | 0.2% | 16.4% | 4.7% | 49.1% | 0.4% | 18.2% | 4.7% | 6.3% | 45931 |
| C1 | 0.1% | 25.6% | 2.5% | 50.2 | 0.2% | 12.3% | 3.6% | 5.5% | 3694 |
| C2 | 0.3% | 8.1% | 4.0% | 72% | 0.1% | 10.6% | 1.8% | 3.1% | 1561 |
| C3 | 0.2% | 5.7% | 3.3% | 39.4% | 0.5% | 42.6% | 5.6% | 2.8% | 2561 |
| C4 | 0.1% | 6.9% | 3.1% | 59.1% | 0.3% | 20.5% | 4.4% | 2.6% | 1858 |
| C5 |  | 19.4% | 10.4% | 49.5% | 1.5% | 8.1% | 4.9% | 6.2% | 1438 |
| C6 | 0.4% | 14.2% | 3.4% | 57.2% | 0.0% | 16.6% | 3.0% | 5.2% | 3334 |
| C8 | 0.4% | 6.1% | 2.7% | 54.8% | 0.4% | 26.0% | 5.1% | 4.5% | 1046 |
| C9 | 0.0% | 7.8% | 6.3% | 65.6% | 0.2% | 13.6% | 3.0% | 3.5% | 4790 |
| C10 | 0.2% | 20.5% | 7.4% | 44.4% | 0.9% | 15.7% | 5.8% | 5.0% | 4160 |
| C11 | 0.1% | 4.5% | 3.6% | 76.9% | 0.1% | 5.5% | 2.0% | 7.4% | 2885 |
| C12 | 0.9% | 1.5% | 3.8% | 40.2% | 0.1% | 41.1% | 6.7% | 5.7% | 823 |
| C13 | 0.5% | 10.1 % | 5.9% | 30.2% | 0.3% | 35.2% | 6.3% | 11.5% | 3589 |
| C14 | 0.1% | 24.4% | 6.3% | 42.5% | 0.7% | 13.1% | 5.9% | 6.9% | 3517 |
| C15 |  | 39.0% | 4.6% | 31.9% | 0.5% | 11.2% | 6.2% | 6.6% | 3964 |
| C16 | 0.2% | 5.0% | 2.2% | 43.7% | 0.6% | 38.5% | 7.7% | 2.0% | 1550 |
| C17 | 0.1% | 22.5% | 3.4% | 46.5% | 0.3% | 14.8% | 4.9% | 7.5% | 5161 |

Table 1. Students’ ethnicity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Female | Male | Non-binary | Unknown | Total Population |
| All | 58.2% | 41.8% | 0.0% | 0.0% | 45931 |
| C1 | 49.5% | 50.5% | 0.0% |  | 3694 |
| C2 | 62.9% | 37.1% |  |  | 1561 |
| C3 | 56.4% | 43.5% |  |  | 2561 |
| C4 | 68.4% | 31.6% |  |  | 1858 |
| C5 | 61.3% | 38.6% | 0.1% |  | 1438 |
| C6 | 58.7% | 41.2% | 0.0% |  | 3334 |
| C8 | 62.7% | 37.2% | 0.1% |  | 1046 |
| C9 | 57.1% | 42.8% | 0.1% |  | 4790 |
| C10 | 57.5% | 42.4% | 0.1% |  | 4160 |
| C11 | 62.3% | 37.7% |  |  | 2885 |
| C12 | 59.3% | 40.7% |  |  | 823 |
| C13 | 58.9% | 41.0% | 0.1% |  | 3589 |
| C14 | 58.8% | 41.1% | 0.1% |  | 3517 |
| C15 | 51.7% | 48.2% |  | 0.1% | 3964 |
| C16 | 66.0% | 34.0% |  |  | 1550 |
| C17 | 58.6% | 41.4% |  |  | 5161 |

Table 2. Students’ gender

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1998 and earlier (age 21 or older) | 1999 (age 20) | 2000 (age 19) | 2001 (age 18) | 2002 and later (age 17 or younger) | Total Population |
| All | 0.9% | 1.5% | 20.2% | 76.7% | 0.6% | 45931 |
| C1 | 0.4% | 0.6% | 16.2% | 81.9% | 0.8% | 3694 |
| C2 | 1.2% | 0.8% | 19.0% | 78.5% | 0.4% | 1561 |
| C3 | 0.0% | 0.7% | 21.0% | 77.9% | 0.3% | 2561 |
| C4 | 0.6% | 10.2% | 51.0% | 37.8% | 0.4% | 1858 |
| C5 | 0.4% | 1.2% | 17.0% | 80.8% | 0.6% | 1438 |
| C6 | 0.4% | 0.8% | 19.9% | 78.5% | 0.5% | 3334 |
| C8 | 0.5% | 1.1% | 19.6% | 78.3% | 0.6% | 1046 |
| C9 | 0.7% | 1.4% | 18.1% | 79.1% | 0.7% | 4790 |
| C10 | 0.2% | 1.0% | 18.2% | 80.1% | 0.6% | 4160 |
| C11 | 0.4% | 0.8% | 17.4% | 80.8% | 0.6% | 2885 |
| C12 | 1.2% | 1.6% | 25.0% | 71.0% | 1.2% | 823 |
| C13 | 6.6% | 2.9% | 22.4% | 67.3% | 0.7% | 3589 |
| C14 | 0.8% | 1.5% | 19.1% | 78.0% | 0.6% | 3517 |
| C15 | 0.2% | 0.6% | 17.2% | 81.2% | 0.7% | 3964 |
| C16 | 0.2% | 0.6% | 22.2% | 76.5% | 0.4% | 1550 |
| C17 | 0.3% | 0.8% | 18.8% | 79.5% | 0.6% | 5161 |

Table 3. Students’ birth year

In fall 2019, among the 45931 first-year students, 13315 (29.0%) took courses where IL instruction was included; and 32616 (71.0%) did not. For students who did take courses where IL instruction was offered, most took just one such course. A small percentage took more than one – 2068 (4.5%) students took two courses with IL instruction, 66 (0.1%) took three or four. Across all participating institutions, IL instruction was provided for 813 courses that 2019-2020 first-year students enrolled in. It represents 34.9% of the total number of courses for which IL instruction was provided in fall 2019.

For each participating institution, Table 4 delineates the percentage of 2019-2020 first-year students enrolled in different number of courses where IL instruction was provided in fall 2019, and Table 5 shows the number/percentage of fall2019 courses taken by 2019-2020 first-year students that included IL instruction.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Percentage of 2019-2020 First-year Students Enrolled in Courses with IL Instruction in Fall 2019 | | | | | |
| 0 Course | 1 Course | 2 Courses | 3 Courses | 4 Courses | Total Population |
| All | 71.0% | 24.3% | 4.5% | 0.1% | 0.0% | 45931 |
| C1 | 79.6% | 17.7% | 2.4% | 0.3% | 0.0% | 3694 |
| C2 | 20.6% | 47.0% | 32.2% | 0.3% |  | 1561 |
| C3 | 82.5% | 16.9% | 0.5% |  |  | 2561 |
| C4 | 84.3% | 13.5% | 1.9% | 0.2% |  | 1858 |
| C5 | 84.8% | 14.5% | 0.7% |  |  | 1438 |
| C6 | 75.1% | 22.6% | 2.2% | 0.0% | 0.0% | 3334 |
| C8 | 49.4% | 38.9% | 10.7% | 1.0% |  | 1046 |
| C9 | 43.1% | 46.6% | 10.2% | 0.1% |  | 4790 |
| C10 | 87.9% | 11.7% | 0.5% |  |  | 4160 |
| C11 | 93.6% | 6.4% | 0.0% |  |  | 2885 |
| C12 | 32.9% | 57.6% | 8.6% | 0.7% | 0.1% | 823 |
| C13 | 85.2% | 13.8% | 1.0% |  |  | 3589 |
| C14 | 78.9% | 19.8% | 1.3% | 0.0% |  | 3517 |
| C15 | 73.9% | 22.9% | 3.1% | 0.1% |  | 3964 |
| C16 | 48.9% | 40.8% | 9.8% | 0.5% |  | 1550 |
| C17 | 62.4% | 31.7% | 5.6% | 0.2% |  | 5161 |

Table 4. Percentage of students enrolled in different number of courses with IL Instruction

|  |  |  |
| --- | --- | --- |
|  | Courses Including IL Instruction in Fall 2019 | |
| # of courses with IL instruction that 2019-2020 FY students took | % of the total courses with IL instruction |
| All | 813 | 34.9% |
| C1 | 48 | 47.5% |
| C2 | 74 | 74.7% |
| C3 | 21 | 43.8% |
| C4 | 23 | 27.7% |
| C5 | 20 | 29.4% |
| C6 | 43 | 31.6% |
| C8 | 43 | 37.1% |
| C9 | 162 | 52.1% |
| C10 | 24 | 9.3% |
| C11 | 10 | 20.4% |
| C12 | 34 | 36.2% |
| C13 | 45 | 34.4% |
| C14 | 41 | 22.8% |
| C15 | 48 | 16.2% |
| C16 | 63 | 46.0% |
| C17 | 114 | 29.8% |

Table 5. Percentage of courses with IL instruction taken by 2019-2020 first-year students

Combining all participating institutions, among the first-year students enrolled in courses where IL instruction was provided, the majority had received the IL instruction in one one-shot IL session (63.7%), in the in-person format (99.5%), and only had librarian(s) as the IL instruction provider. On average, students received 100.89 minutes of IL instruction in fall 2019. As shown in Table 6, among different participating institutions, there was variation in terms of frequency distributions of the number of one-shot sessions and the average duration of IL instruction minutes, while the format and provider of IL instruction tended to be more consistent.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | One-shot Sessions | | | Format of IL Instruction | | | Provider of IL instruction | | Average duration of IL instruction minutes | Total population |
| 1 session | 2 sessions | 3 or more sessions | In-person | Online | Both | Librarian(s) | Other (course instructor, librarian working with course instructor, paraprofessional library staff, undergraduate peer mentor trained by librarians) |
| All | 63.7% | 26.7% | 9.6% | 99.5% | 0.3% | 0.2% | 97.3% | 2.7% | 100.89 | 13315 |
| C1 | 59.9% | 19.7% | 20.4% | 100.0% |  |  | 100.0% |  | 64.08 | 753 |
| C2 | 52.4% | 33.8% | 13.8% | 97.4% | 1.5% | 1.1% | 100.0% |  | 72.02 | 1240 |
| C3 | 55.9% | 41.8% | 2.2% | 100.0% |  |  | 99.1% | 0.9% | 93.24 | 447 |
| C4 | 58.1% | 21.0% | 20.9% | 96.6% | 2.1% | 1.3% | 100.0% |  | 117.51 | 291 |
| C5 | 59.6% | 5.0% | 35.4% | 95.4% | 4.1% | 0.5% | 100.0% |  | 98.19 | 218 |
| C6 | 90.8% | 8.9% | 0.2% | 100.0% |  |  | 100.0% |  | 73.79 | 829 |
| C8 | 73.9% | 23.4% | 2.6% | 100.0% |  |  | 96.6% | 3.4% | 100.47 | 529 |
| C9 | 37.3% | 45.9% | 16.8% | 100.0% |  |  | 98.2% | 1.8% | 135.01 | 2727 |
| C10 | 35.4% | 38.8% | 25.8% | 100.0% |  |  | 100.0% |  | 120.64 | 505 |
| C11 | 99.5% | 0.5% |  | 100.0% |  |  |  | 100.0% | 45.25 | 185 |
| C12 | 36.6% | 50.4% | 13.0% | 100.0% |  |  | 100.0% |  | 144.70 | 552 |
| C13 | 87.0% | 7.7% | 5.3% | 100.0% |  |  | 100.0% |  | 62.14 | 531 |
| C14 | 79.0% | 19.4% | 1.6% | 100.0% |  |  | 100.0% |  | 80.69 | 742 |
| C15 | 78.4% | 15.2% | 6.4% | 100.0% |  |  | 90.3% | 9.7% | 125.13 | 1036 |
| C16 | 77.7% | 20.7% | 1.6% | 98.2% | 0.5% | 1.3% | 100.0% |  | 98.47 | 792 |
| C17 | 84.5% | 15.0% | 0.5% | 100.0% |  |  | 100.0% |  | 91.02 | 1938 |

Table 6. Percentage of students in terms of number of one-shot sessions, instruction format, instruction provider, and average duration of instruction for the IL instruction they received

## Part I. 3. 2. Effect of IL instruction on Students’ Academic Success

As explained earlier, the academic success of the 2019-2020 first-year students was measured by two indicators – their GPA and the number of credits they earned in fall 2019. Thus, when examining IL instruction’s impact students’ academic success, the independent and dependent variables are as follows:

* Independent variable – whether or not students took courses in fall 2019 where IL instruction was included (Yes/No)
* Dependent variable 1 – students’ GPA in fall 2019
* Dependent variable 2 – students’ earned credits in fall 2019

We examined the effect of IL instruction on the two dependent variables both separately and collectively.

To examine the effect of IL instruction on students’ GPA and earned credits separately, we used Welch’s t Test because it is a robust test for samples without equal variances. In our study, the group of students that took courses with IL instruction, and the group that did not, had unequal sizes, rendering Welch’s t Test a better option than Student t Test.

Overall, results of the t Tests indicated that, with data from all participating institutions combined, whether or not students took courses with IL instruction in fall 2019, did not have much of an impact on their earned credits or GPA in that semester. As shown in Table 7, regarding the effect of IL instruction on earned credits, the *p value* was 0.06, indicating that the observed effect was statistically significant (the chance of being attributed to sampling error alone is 6%). Those that took courses with IL instruction on average earned 0.14 hours of credits less than those that did not. This magnitude of this difference was extremely weak. Measured by Cohen’s d, the effect size was merely -0.02, indicating that the two groups' means differed only by 0.02 standard deviations and therefore is trivial. Regarding the effect of IL instruction GPA, the *p value* was 0.95, indicating that the observed effect was not statistically significant. There was no difference between the GPA of those that took courses with IL instruction and those that did not, given that Cohen’s d was 0.00.

For each participating institution, the t Test results were also presented in Table 7. All of the statistically significant values (p Value equal to or less than 0.1) were highlighted in red. Meanwhile, all of the Cohen’s d values that could be rounded up to .2 were also highlighted in red. Cohen suggested that d = 0.2 be considered a “small” effect size, 0.5 represents a “medium” effect size and 0.8 a “large” effect size. There was only one institution, C4, where taking courses with IL instruction had a statistically significant, close to medium-sized, positive effect on students’ GPA and earned credits.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for IL Instruction’s Effect on Earned Credits and GPA Respectively | | | | | | | |
| IL Instruction (Yes/No) \* Earned Credits in Fall 2019 | | | | IL Instruction (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -1.91 | 0.06 | -0.14 | -0.02 | 0.07 | 0.95 | 0.00 | 0.00 |
| C1 | 3.71 | 0.00 | 2.15 | 0.16 | 2.73 | 0.01 | 0.11 | 0.11 |
| C2 | 1.77 | 0.08 | 0.45 | 0.11 | 0.11 | 0.91 | 0.01 | 0.01 |
| C3 | 0.45 | 0.65 | 0.08 | 0.02 | 1.34 | 0.18 | 0.06 | 0.07 |
| C4 | 10.30 | 0.00 | 2.61 | 0.47 | 6.91 | 0.00 | 0.43 | 0.35 |
| C5 | -0.81 | 0.42 | -0.25 | -0.06 | -0.48 | 0.63 | -0.04 | -0.04 |
| C6 | 1.26 | 0.21 | 0.19 | 0.05 | -1.81 | 0.07 | -0.07 | -0.07 |
| C8 | 0.81 | 0.42 | 0.16 | 0.05 | 0.21 | 0.83 | 0.01 | 0.01 |
| C9 | 1.23 | 0.22 | 0.14 | 0.04 | 0.21 | 0.83 | 0.01 | 0.01 |
| C10 | -0.58 | 0.56 | -0.10 | -0.03 | -2.74 | 0.01 | -0.13 | -0.13 |
| C11 | -1.15 | 0.25 | -0.25 | -0.09 | 0.79 | 0.43 | 0.06 | 0.06 |
| C12 | 2.49 | 0.01 | 0.84 | 0.19 | 1.44 | 0.15 | 0.13 | 0.11 |
| C13 | 1.83 | 0.07 | 0.35 | 0.08 | -1.71 | 0.09 | -0.08 | -0.08 |
| C14 | -2.04 | 0.04 | -0.29 | -0.08 | 2.63 | 0.01 | 0.10 | 0.11 |
| C15 | 0.77 | 0.44 | 0.34 | 0.03 | 0.97 | 0.33 | 0.03 | 0.03 |
| C16 | -1.21 | 0.23 | -0.24 | -0.06 | -1.52 | 0.13 | -0.08 | -0.08 |
| C17 | -0.08 | 0.94 | -0.01 | 0.00 | -1.29 | 0.20 | -0.03 | -0.04 |

Table 7. Impact of IL instruction on students’ GPA and earned credits respectively

To examine the effect of IL instruction on the combination of students’ GPA and earned credits, we used MANOVA for analysis. Pillai’s trace was chosen as the statistic as it is the most robust when sample sizes are unequal. Partial Eta squared (ηp2) was used as the effect size measure, which was very small for all participating institutions, as shown in Table 8. This finding suggested that whether or not students took courses where IL instruction was provided, had basically no impact on their academic success, measured by the combination of students’ GPA and earned credits.

|  |  |  |  |
| --- | --- | --- | --- |
|  | One-way MANOVA for IL Instruction’s Effect on Earned Credits and GPA Combined | | |
| IL Instruction (Yes/No) \* Combined Dependent Variables (earned credits and GPA in fall 2019) | | |
| Pillai's trace | sig | ηp2 |
| All | 0.00 | 0.14 | 0.00 |
| C1 | 0.00 | 0.00 | 0.00 |
| C2 | 0.01 | 0.02 | 0.01 |
| C3 | 0.00 | 0.32 | 0.00 |
| C4 | 0.03 | 0.00 | 0.03 |
| C5 | 0.00 | 0.65 | 0.00 |
| C6 | 0.01 | 0.00 | 0.01 |
| C8 | 0.00 | 0.64 | 0.00 |
| C9 | 0.00 | 0.38 | 0.00 |
| C10 | 0.00 | 0.00 | 0.00 |
| C11 | 0.00 | 0.06 | 0.00 |
| C12 | 0.01 | 0.02 | 0.01 |
| C13 | 0.00 | 0.00 | 0.00 |
| C14 | 0.01 | 0.00 | 0.01 |
| C15 | 0.00 | 0.60 | 0.00 |
| C16 | 0.00 | 0.32 | 0.00 |
| C17 | 0.00 | 0.19 | 0.00 |

Table 8. Impact of IL instruction on students’ GPA and earned credits combined

## Part I. 3. 3. Effect of Teach Method on Students’ Academic Success

Among the four teaching methods for IL instruction, “Lecture” was the most popular one, experienced by 87.1% of all first-year students across the participating institutions, whereas “Flipped Classroom” was the least popular one and only 18.7% of the students experienced it in the IL instruction they received. Table 9 also includes the percentage of students who experienced each teaching method at each participating campus, and the variation was notable.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Percentage of Students Exposed to Different Teaching Methods | | | | |
| Lecture | Flipped Classroom | Directed Practice | Active Learning | Total Population |
| All | 87.1% | 18.7% | 45.8% | 74.2% | 13315 |
| C1 | 100.0% |  | 53.9% | 41.4% | 753 |
| C2 | 78.3% | 36.6% | 62.1% | 80.0% | 1240 |
| C3 | 89.5% |  | 48.8% | 71.6% | 447 |
| C4 | 97.9% |  | 49.1% | 95.9% | 291 |
| C5 | 100.0% |  | 70.2% | 38.1% | 218 |
| C6 | 58.3% |  | 29.0% | 42.0% | 829 |
| C8 | 81.5% | 28.4% | 67.3% | 91.5% | 529 |
| C9 | 100.0% | 55.1% | 100.0% |  | 2727 |
| C10 | 100.0% |  | 52.1% | 85.9% | 505 |
| C11 | 100.0% |  |  |  | 185 |
| C12 | 56.9% | 47.6% | 17.8% | 90.8% | 552 |
| C13 | 99.6% |  | 20.5% | 65.0% | 531 |
| C14 | 85.8% | 0.4% | 33.3% | 70.6% | 742 |
| C15 | 93.1% |  | 62.5% | 35.1% | 1036 |
| C16 | 58.6% | 15.4% | 78.0% | 68.1% | 792 |
| C17 | 89.0% |  | 94.4% | 83.7% | 1938 |

Table 9. Percentage of students in terms of the teaching methods used in the IL instruction they received

With regards to the impact of each teaching method on students’ GPA and earned credits respectively, Welch’s test was conducted.

For the “Lecture” method, combining all participating institutions, students who experienced it, on average earned 1.23 more credits, and had a GPA higher by 0.06, than those who did not experience it in their IL instruction. As shown in Table 10, Cohen’s d indicated that whether or not students experienced the “Lecture” method, had a positive but small effect on students’ earned credits, and negligible effect on their GPA, although both effects were statistically significant. As for individual institutions, there were a few where a small positive effect was detected for both GPA and earned credits.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the “Lecture” Method’s Effect on Earned Credits and GPA Respectively | | | | | | | |
|  | Lecture (Yes/No) \* Earned Credits in Fall 2019 | | | | Lecture (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | 8.86 | 0.00 | 1.23 | 0.18 | 2.37 | 0.02 | 0.06 | 0.06 |
| C1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C2 | 1.77 | 0.08 | 0.47 | 0.12 | -0.04 | 0.97 | 0.00 | 0.00 |
| C3 | 1.22 | 0.23 | 0.60 | 0.19 | 1.34 | 0.19 | 0.19 | 0.22 |
| C4 | -0.15 | 0.89 | -0.34 | -0.10 | 0.10 | 0.92 | 0.05 | 0.06 |
| C5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C6 | 0.72 | 0.47 | 0.19 | 0.05 | -0.86 | 0.39 | -0.06 | -0.06 |
| C8 | 1.14 | 0.26 | 0.46 | 0.14 | -0.38 | 0.71 | -0.04 | -0.05 |
| C9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C10 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | 2.24 | 0.03 | 0.78 | 0.19 | 2.63 | 0.01 | 0.24 | 0.23 |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | 0.34 | 0.73 | 0.14 | 0.04 | 1.72 | 0.09 | 0.18 | 0.19 |
| C15 | -0.60 | 0.55 | -1.00 | -0.08 | -0.78 | 0.44 | -0.08 | -0.09 |
| C16 | 0.07 | 0.95 | 0.02 | 0.01 | -1.92 | 0.06 | -0.14 | -0.14 |
| C17 | -0.48 | 0.63 | -0.13 | -0.04 | 1.39 | 0.17 | 0.09 | 0.10 |

Table 10. Impact of the “Lecture” method on students’ GPA and earned credits respectively

For the “Flipped Classroom” method, combining all participating institutions, students who experienced it, on average earned 1.60 less credits, and had a GPA lower by 0.08, than those who did not experience it in their IL instruction. As shown in Table 11, Cohen’s d indicated that whether or not students experienced the “Flipped Classroom” method, had a negative but small effect on students’ earned credits, and negligible effect on their GPA, although both effects were statistically significant. As for individual institutions, it was interesting to note that for C14, a medium-sized positive effect was detected for earned credits, but a medium-sized negative effect for GPA.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the “Flipped Classroom” Method’s Effect on Earned Credits and GPA Respectively | | | | | | | |
| Flipped Classroom (Yes/No) \* Earned Credits in Fall 2019 | | | | Flipped Classroom (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -15.18 | 0.00 | -1.60 | -0.24 | -3.79 | 0.00 | -0.08 | -0.09 |
| C1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C2 | 0.57 | 0.57 | 0.13 | 0.03 | 0.11 | 0.91 | 0.01 | 0.01 |
| C3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C8 | 1.24 | 0.21 | 0.34 | 0.11 | 0.26 | 0.80 | 0.02 | 0.02 |
| C9 | 1.95 | 0.05 | 0.30 | 0.08 | 2.05 | 0.04 | 0.08 | 0.08 |
| C10 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | -1.50 | 0.14 | -0.52 | -0.13 | -1.33 | 0.18 | -0.12 | -0.11 |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | 3.23 | 0.07 | 1.91 | 0.56 | -0.78 | 0.52 | -0.46 | -0.51 |
| C15 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C16 | -2.58 | 0.01 | -1.19 | -0.29 | -3.16 | 0.00 | -0.35 | -0.34 |
| C17 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Table 11. Impact of the “Flipped Classroom” method on students’ GPA and earned credits respectively

For the “Directed Practice” method, combining all participating institutions, students who experienced it, on average earned 0.68 more credits, and had a GPA higher by 0.03, than those who did not experience it in their IL instruction. As shown in Table 12, Cohen’s d indicated that whether or not students experienced the “Directed Practice” method, had a trivial effect on students’ earned credits and GPA. As for individual institutions, there were three where a small negative effect was detected for either GPA or earned credits, and one where a small positive effect was detected.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the “Directed Practice” Method’s Effect on Earned Credits and GPA Respectively | | | | | | | |
| Directed Practice (Yes/No) \* Earned Credits in Fall 2019 | | | | Directed Practice (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | 5.72 | 0.00 | 0.68 | 0.10 | 1.88 | 0.06 | 0.03 | 0.03 |
| C1 | 0.17 | 0.86 | 0.18 | 0.01 | 0.42 | 0.67 | 0.03 | 0.03 |
| C2 | -0.65 | 0.52 | -0.15 | -0.04 | -1.40 | 0.16 | -0.08 | -0.08 |
| C3 | -2.11 | 0.04 | -0.63 | -0.20 | -1.87 | 0.06 | -0.15 | -0.18 |
| C4 | -0.40 | 0.69 | -0.16 | -0.05 | -0.11 | 0.92 | -0.01 | -0.01 |
| C5 | 1.47 | 0.14 | 0.96 | 0.22 | 1.10 | 0.27 | 0.19 | 0.17 |
| C6 | -0.80 | 0.42 | -0.22 | -0.06 | 0.34 | 0.74 | 0.03 | 0.03 |
| C8 | 0.81 | 0.42 | 0.25 | 0.08 | -0.07 | 0.95 | -0.01 | -0.01 |
| C9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C10 | -1.33 | 0.18 | -0.44 | -0.12 | -0.46 | 0.65 | -0.04 | -0.04 |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | 0.22 | 0.82 | 0.11 | 0.03 | 0.71 | 0.48 | 0.08 | 0.08 |
| C13 | 0.57 | 0.57 | 0.23 | 0.06 | -1.24 | 0.22 | -0.13 | -0.13 |
| C14 | 0.31 | 0.76 | 0.09 | 0.03 | -0.57 | 0.57 | -0.04 | -0.05 |
| C15 | -0.91 | 0.36 | -0.73 | -0.06 | 1.14 | 0.26 | 0.07 | 0.08 |
| C16 | -1.74 | 0.08 | -0.57 | -0.14 | -2.21 | 0.03 | -0.19 | -0.18 |
| C17 | -1.33 | 0.19 | -0.37 | -0.11 | -1.11 | 0.27 | -0.10 | -0.12 |

Table 12. Impact of the “Directed Practice” method on students’ GPA and earned credits respectively

For the “Active Learning” method, combining all participating institutions, students who experienced it, on average earned 2.04 less credits, and had GPA no different than those who did not experience it in their IL instruction. As shown in Table 13, Cohen’s d indicated that whether or not students experienced the “Active Learning” method, had a small negative effective on students’ earned credits, and no effect on their GPA. As for individual institutions, much variation existed.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the “Active Learning” Method’s Effect on Earned Credits and GPA Respectively | | | | | | | |
| Active Learning (Yes/No) \* Earned Credits in Fall 2019 | | | | Active Learning (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -12.52 | 0.00 | -2.04 | -0.30 | -0.02 | 0.98 | 0.00 | 0.00 |
| C1 | 1.90 | 0.06 | 2.07 | 0.14 | 1.29 | 0.20 | 0.09 | 0.09 |
| C2 | -1.72 | 0.09 | -0.45 | -0.12 | -1.59 | 0.11 | -0.11 | -0.11 |
| C3 | 3.34 | 0.00 | 1.19 | 0.38 | 4.24 | 0.00 | 0.39 | 0.46 |
| C4 | -0.46 | 0.65 | -0.52 | -0.15 | 0.36 | 0.73 | 0.10 | 0.11 |
| C5 | 1.44 | 0.15 | 0.84 | 0.20 | 2.31 | 0.02 | 0.36 | 0.32 |
| C6 | 0.58 | 0.56 | 0.15 | 0.04 | 1.33 | 0.19 | 0.09 | 0.09 |
| C8 | -3.41 | 0.00 | -1.36 | -0.43 | -3.38 | 0.00 | -0.37 | -0.40 |
| C9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C10 | -0.03 | 0.98 | 0.20 | 0.05 | 0.51 | 0.61 | 0.07 | 0.07 |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | -1.17 | 0.25 | -0.66 | -0.16 | -2.38 | 0.02 | -0.33 | -0.31 |
| C13 | -0.68 | 0.50 | -0.24 | -0.06 | 0.15 | 0.88 | 0.01 | 0.01 |
| C14 | 2.65 | 0.01 | 0.72 | 0.21 | 0.54 | 0.59 | 0.04 | 0.04 |
| C15 | 0.39 | 0.70 | 0.31 | 0.03 | -1.28 | 0.20 | -0.08 | -0.09 |
| C16 | 3.12 | 0.00 | 1.02 | 0.25 | 4.32 | 0.00 | 0.34 | 0.34 |
| C17 | 2.13 | 0.03 | 0.43 | 0.13 | -1.51 | 0.13 | -0.08 | -0.09 |

Table 13. Impact of the “Active Learning” method on students’ GPA and earned credits respectively

To examine the impact of each teaching method on the combination of students’ GPA and earned credits, MANOVA was conducted. According to Table 14, Pillai’s trace and partial Eta squared both indicated that none of the four teaching methods had much of an effect on students’ academic success, measured by their earned credits and GPA combined.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | One-way MANOVA for Each Teaching Method’s Effect on Earned Credits and GPA Combined | | | | | | | | | | | |
| Lecture | | | Flipped Classroom | | | Directed Practice | | | Active Learning | | |
| Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 |
| All | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 |
| C1 | N/A | N/A | N/A | N/A | N/A | N/A | 0.00 | 0.92 | 0.00 | 0.01 | 0.14 | 0.01 |
| C2 | 0.01 | 0.01 | 0.01 | 0.00 | 0.72 | 0.00 | 0.00 | 0.29 | 0.00 | 0.00 | 0.25 | 0.00 |
| C3 | 0.00 | 0.35 | 0.00 | N/A | N/A | N/A | 0.01 | 0.09 | 0.01 | 0.04 | 0.00 | 0.04 |
| C4 | 0.00 | 0.87 | 0.00 | N/A | N/A | N/A | 0.00 | 0.89 | 0.00 | 0.01 | 0.48 | 0.01 |
| C5 | N/A | N/A | N/A | N/A | N/A | N/A | 0.01 | 0.31 | 0.01 | 0.03 | 0.05 | 0.03 |
| C6 | 0.01 | 0.05 | 0.01 | N/A | N/A | N/A | 0.00 | 0.23 | 0.00 | 0.00 | 0.32 | 0.00 |
| C8 | 0.01 | 0.26 | 0.01 | 0.00 | 0.40 | 0.00 | 0.01 | 0.36 | 0.00 | 0.010 | 0.27 | 0.00 |
| C9 | N/A | N/A | N/A | 0.00 | 0.07 | 0.00 | N/A | N/A | N/A | N/A | N/A | N/A |
| C10 | N/A | N/A | N/A | N/A | N/A | N/A | 0.01 | 0.27 | 0.01 | 0.00 | 0.86 | 0.00 |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | 0.01 | 0.03 | 0.01 | 0.00 | 0.33 | 0.00 | 0.00 | 0.66 | 0.00 | 0.01 | 0.07 | 0.01 |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | 0.01 | 0.06 | 0.01 | 0.00 | 0.54 | 0.00 |
| C14 | 0.01 | 0.07 | 0.01 | 0.01 | 0.03 | 0.01 | 0.01 | 0.07 | 0.01 | 0.03 | 0.00 | 0.03 |
| C15 | 0.00 | 0.69 | 0.00 | N/A | N/A | N/A | 0.00 | 0.13 | 0.00 | 0.00 | 0.23 | 0.00 |
| C16 | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | 0.02 | 0.01 | 0.11 | 0.01 | 0.02 | 0.00 | 0.02 |
| C17 | 0.00 | 0.01 | 0.00 | N/A | N/A | N/A | 0.00 | 0.47 | 0.00 | 0.01 | 0.00 | 0.01 |

Table 14. Impact of each teaching method on students’ GPA and earned credits combined

## Part I. 3. 4. Effect of IL Instruction Characteristic on Students’ Academic Success

Among the six characteristics of IL instruction, “Course Integration” was the most popular one, experienced by 85.4% of first-year students in all participating institutions, whereas “Library Tour” was the least popular one and only 10.1% of the students experienced it in the IL instruction they received. Table 15 also includes the percentage of students who experienced each IL instruction characteristic at each participating campus, and there was notable variation among them.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Percentage of Students Exposed to Different IL Instruction Characteristics | | | | | | |
| Course Integration | Online Tutorial or Digital Learning Object | Research Guide | Librarian(s) Involved in Course Design | Librarian(s) Involved in Assignment Design | Library Tour | Total Population |
| All | 85.4% | 28.9% | 48.0% | 16.9% | 25.7% | 10.1% | 13315 |
| C1 | 82.9% | 22.8% | 2.9% | 0.0% | 12.0% |  | 753 |
| C2 | 57.1% | 64.0% | 71.6% | 18.5% | 46.3% | 66.5% | 1240 |
| C3 | 87.7% | 11.4% | 10.7% | 11.2% | 21.5% | 12.3% | 447 |
| C4 | 100.0% | 3.4% | 68.7% | 6.5% | 7.2% |  | 291 |
| C5 | 100.0% | 4.6% | 22.9% | 35.3% | 37.6% | 7.3% | 218 |
| C6 | 32.7% | 28.8% | 77.0% |  | 15.8% | 10.4% | 829 |
| C8 | 76.0% | 35.5% | 46.5% |  |  |  | 529 |
| C9 | 100.0% | 53.4% | 62.4% | 53.4% | 53.4% | 1.8% | 2727 |
| C10 | 59.4% | 9.3% | 40.2% | 4.8% | 4.2% |  | 505 |
| C11 |  |  |  | 88.1% | 88.1% |  | 185 |
| C12 | 81.2% | 49.5% | 3.4% |  | 38.0% | 56.7% | 552 |
| C13 | 100.0% | 24.3% | 16.9% | 0.4% |  |  | 531 |
| C14 | 98.0% | 3.8% |  |  | 27.2% |  | 742 |
| C15 | 96.4% | 4.2% | 27.4% | 1.4% | 5.6% | 0.1% | 1036 |
| C16 |  | 12.8% | 10.5% | 0.1% | 0.1% |  | 792 |
| C17 | 100.0% | 15.9% | 98.9% | 11.2% | 16.6% |  | 1938 |

Table 15. Percentage of students in terms of the characteristics of the IL instruction they received

Regarding the impact of each IL instruction characteristic on students’ GPA and earned credits respectively, Welch’s test was conducted.

For “Course Integration”, combining all participating institutions, students who experienced it, on average earned 0.61 more credits, and had a GPA higher by 0.02, than those who did not experience it in their IL instruction. As shown in Table 16, Cohen’s d indicated that whether or not students experienced “Course Integration”, had a trivial effect on students’ earned credits and GPA. As for individual institutions, there was one institution where a small negative effect was detected for earned credits, and another one where a close to medium-sized positive effect was detected.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the Effect of “Course Integration” on Earned Credits and GPA Respectively | | | | | | | |
| Course Integration (Yes/No) \* Earned Credits in Fall 2019 | | | | Course Integration (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | 4.55 | 0.00 | 0.61 | 0.09 | 0.94 | 0.35 | 0.02 | 0.02 |
| C1 | 5.35 | 0.00 | 5.95 | 0.42 | -0.84 | 0.41 | -0.08 | -0.08 |
| C2 | -1.08 | 0.28 | -0.24 | -0.06 | -1.43 | 0.15 | -0.08 | -0.08 |
| C3 | 0.66 | 0.51 | 0.38 | 0.12 | -0.04 | 0.97 | -0.01 | -0.01 |
| C4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C6 | -0.58 | 0.56 | -0.16 | -0.04 | -0.34 | 0.74 | -0.03 | -0.03 |
| C8 | -1.02 | 0.31 | -0.31 | -0.10 | -0.29 | 0.77 | -0.03 | -0.03 |
| C9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C10 | -0.03 | 0.98 | -0.01 | 0.00 | -1.59 | 0.11 | -0.14 | -0.14 |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | -0.16 | 0.87 | -0.06 | -0.02 | -0.39 | 0.69 | -0.04 | -0.04 |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | -0.97 | 0.35 | -1.05 | -0.31 | 0.29 | 0.77 | 0.09 | 0.10 |
| C15 | -0.05 | 0.96 | -0.12 | -0.01 | -0.66 | 0.52 | -0.11 | -0.12 |
| C16 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C17 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Table 16. Impact of “Course Integration” on students’ GPA and earned credits respectively

For “Online Tutorial or Digital Learning Object”, combining all participating institutions, students who experienced it, on average earned 1.15 less credits, and had a GPA lower by 0.06, than those who did not experience it in their IL instruction. As shown in Table 17, Cohen’s d indicated that whether or not students experienced “Online Tutorial or Digital Learning Object”, had a negative but small effect on students’ earned credits, and negligible effect on their GPA, although both effects were statistically significant. As for individual institutions, much variation existed.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the Effect of “Online Tutorial or Digital Learning Object” on Earned Credits and GPA Respectively | | | | | | | |
| Online Tutorial or Digital Learning Object (Yes/No) \* Earned Credits in Fall 2019 | | | | Online Tutorial or Digital Learning Object (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -10.69 | 0.00 | -1.15 | -0.17 | -3.21 | 0.00 | -0.06 | -0.06 |
| C1 | -5.73 | 0.00 | -5.85 | -0.41 | -2.19 | 0.03 | -0.18 | -0.19 |
| C2 | 0.30 | 0.76 | 0.07 | 0.02 | -1.10 | 0.27 | -0.07 | -0.07 |
| C3 | 1.58 | 0.12 | 0.59 | 0.19 | 2.04 | 0.05 | 0.22 | 0.26 |
| C4 | 0.73 | 0.48 | 1.07 | 0.30 | 0.38 | 0.72 | 0.13 | 0.14 |
| C5 | 4.82 | 0.00 | 2.08 | 0.49 | 2.60 | 0.02 | 0.62 | 0.55 |
| C6 | 1.07 | 0.29 | 0.31 | 0.08 | 1.38 | 0.17 | 0.11 | 0.11 |
| C8 | 1.06 | 0.29 | 0.29 | 0.09 | 0.51 | 0.61 | 0.04 | 0.05 |
| C9 | 2.21 | 0.03 | 0.34 | 0.09 | 2.09 | 0.04 | 0.08 | 0.08 |
| C10 | 0.93 | 0.36 | 0.42 | 0.11 | 1.72 | 0.09 | 0.24 | 0.24 |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | 0.17 | 0.87 | 0.06 | 0.01 | -0.80 | 0.42 | -0.07 | -0.07 |
| C13 | -3.07 | 0.00 | -1.29 | -0.33 | -1.08 | 0.28 | -0.11 | -0.11 |
| C14 | 1.97 | 0.06 | 1.19 | 0.35 | 0.23 | 0.82 | 0.04 | 0.05 |
| C15 | -0.87 | 0.39 | -1.42 | -0.12 | -0.54 | 0.59 | -0.08 | -0.09 |
| C16 | -2.85 | 0.01 | -1.45 | -0.36 | -3.92 | 0.00 | -0.46 | -0.46 |
| C17 | 2.00 | 0.05 | 0.36 | 0.11 | 1.36 | 0.17 | 0.07 | 0.08 |

Table 17. Impact of “Online Tutorial or Digital Learning Object” on students’ GPA and earned credits respectively

For “Research Guide”, combining all participating institutions, students who experienced it, on average earned 1.40 less credits, and had a GPA higher by 0.04, than those who did not experience it in their IL instruction. As shown in Table 18, Cohen’s d indicated that whether or not students experienced “Research Guide”, had a negative but small effect on students’ earned credits, and negligible effect on their GPA, although both effects were statistically significant. As for individual institutions, there was a mixture of positive and negative effects, and mostly small or negligible in size.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the Effect of “Research Guide” on Earned Credits and GPA Respectively | | | | | | | |
| Research Guide (Yes/No) \* Earned Credits in Fall 2019 | | | | Research Guide (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -12.21 | 0.00 | -1.40 | -0.21 | 2.29 | 0.02 | 0.04 | 0.04 |
| C1 | -3.02 | 0.01 | -4.52 | -0.31 | -0.29 | 0.78 | -0.06 | -0.06 |
| C2 | 1.59 | 0.11 | 0.39 | 0.10 | -0.23 | 0.82 | -0.01 | -0.02 |
| C3 | -0.37 | 0.71 | -0.15 | -0.05 | 0.41 | 0.68 | 0.05 | 0.06 |
| C4 | -1.11 | 0.27 | -0.46 | -0.13 | -0.51 | 0.61 | -0.06 | -0.06 |
| C5 | -2.10 | 0.04 | -1.58 | -0.37 | -1.10 | 0.27 | -0.22 | -0.20 |
| C6 | 0.15 | 0.88 | 0.05 | 0.01 | -0.62 | 0.54 | -0.05 | -0.05 |
| C8 | 1.53 | 0.13 | 0.42 | 0.13 | 1.54 | 0.12 | 0.12 | 0.13 |
| C9 | 3.04 | 0.00 | 0.48 | 0.12 | 3.05 | 0.00 | 0.12 | 0.12 |
| C10 | -1.10 | 0.27 | -0.36 | -0.10 | 0.28 | 0.78 | 0.02 | 0.03 |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | 0.87 | 0.40 | 0.92 | 0.22 | 1.73 | 0.10 | 0.42 | 0.40 |
| C13 | 0.18 | 0.86 | 0.08 | 0.02 | -2.08 | 0.04 | -0.23 | -0.24 |
| C14 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C15 | -0.22 | 0.82 | -0.19 | -0.02 | -0.55 | 0.58 | -0.04 | -0.04 |
| C16 | 0.76 | 0.45 | 0.36 | 0.09 | 1.86 | 0.07 | 0.23 | 0.22 |
| C17 | -0.60 | 0.55 | -0.26 | -0.08 | -0.37 | 0.72 | -0.07 | -0.08 |

Table 18. Impact of “Research Guide” on students’ GPA and earned credits respectively

For “Librarian Involvement in Course Design”, combining all participating institutions, students who experienced it, on average earned 1.38 less credits, and had a GPA higher by 0.01, than those who did not experience it in their IL instruction. As shown in Table 19, Cohen’s d indicated that whether or not students experienced “Librarian Involvement in Course Design”, had a negative but small effect on students’ earned credits, and negligible effect on their GPA. As for individual institutions, there were small to medium-sized positive effects detected for either earned credits or GPA.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the Effect of “Librarian Involvement in Course Design” on Earned Credits and GPA Respectively | | | | | | | |
| Librarian Involvement in Course Design (Yes/No) \* Earned Credits in Fall 2019 | | | | Librarian Involvement in Course Design (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -12.38 | 0.00 | -1.38 | -0.21 | 0.25 | 0.81 | 0.01 | 0.01 |
| C1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C2 | -0.10 | 0.93 | -0.03 | -0.01 | -0.94 | 0.35 | -0.07 | -0.07 |
| C3 | -0.91 | 0.36 | -0.43 | -0.14 | -0.83 | 0.41 | -0.12 | -0.13 |
| C4 | -0.17 | 0.87 | -0.10 | -0.03 | -0.77 | 0.45 | -0.13 | -0.14 |
| C5 | 1.76 | 0.08 | 1.01 | 0.24 | 2.67 | 0.01 | 0.41 | 0.37 |
| C6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C9 | 2.21 | 0.03 | 0.34 | 0.09 | 2.09 | 0.04 | 0.08 | 0.08 |
| C10 | 0.10 | 0.92 | 0.08 | 0.02 | 0.14 | 0.89 | 0.03 | 0.03 |
| C11 | 0.38 | 0.71 | 0.29 | 0.10 | 1.37 | 0.18 | 0.39 | 0.42 |
| C12 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C15 | 0.36 | 0.72 | 1.62 | 0.14 | -0.23 | 0.82 | -0.08 | -0.09 |
| C16 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C17 | 1.42 | 0.16 | 0.35 | 0.11 | 0.94 | 0.35 | 0.06 | 0.07 |

Table 19. Impact of “Librarian Involvement in Course Design” on students’ GPA and earned credits respectively

For “Librarian Involvement in Assignment Design”, combining all participating institutions, students who experienced it, on average earned 1.17 less credits, and had a GPA lower by 0.02, than those who did not experience it in their IL instruction. As shown in Table 20, Cohen’s d indicated that whether or not students experienced “Librarian Involvement in Assignment Design”, had a negative but small effect on students’ earned credits, and negligible effect on their GPA. As for individual institutions, there was some variation in terms of the direction and size of the effect.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the Effect of “Librarian Involvement in Assignment Design” on Earned Credits and GPA Respectively | | | | | | | |
| Librarian Involvement in Assignment Design(Yes/No) \* Earned Credits in Fall 2019 | | | | Librarian Involvement in Assignment Design(Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -9.91 | 0.00 | -1.17 | -0.17 | -1.19 | 0.23 | -0.02 | -0.02 |
| C1 | 1.40 | 0.17 | 2.61 | 0.18 | 0.46 | 0.65 | 0.05 | 0.05 |
| C2 | -0.69 | 0.49 | -0.16 | -0.04 | -1.08 | 0.28 | -0.06 | -0.06 |
| C3 | 0.02 | 0.99 | 0.01 | 0.00 | 0.25 | 0.80 | 0.03 | 0.03 |
| C4 | -1.23 | 0.23 | -1.49 | -0.43 | -1.27 | 0.22 | -0.33 | -0.37 |
| C5 | 1.71 | 0.09 | 0.99 | 0.23 | 2.57 | 0.01 | 0.39 | 0.35 |
| C6 | -0.46 | 0.64 | -0.18 | -0.05 | 0.41 | 0.68 | 0.04 | 0.04 |
| C8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C9 | 2.21 | 0.03 | 0.34 | 0.09 | 2.09 | 0.04 | 0.08 | 0.08 |
| C10 | -1.44 | 0.16 | -0.94 | -0.25 | 0.13 | 0.90 | 0.02 | 0.03 |
| C11 | 0.38 | 0.71 | 0.29 | 0.10 | 1.37 | 0.18 | 0.39 | 0.42 |
| C12 | -1.78 | 0.08 | -0.63 | -0.15 | -1.83 | 0.07 | -0.17 | -0.16 |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | 3.21 | 0.00 | 0.88 | 0.26 | 1.56 | 0.12 | 0.11 | 0.13 |
| C15 | -0.34 | 0.74 | -0.57 | -0.05 | -0.61 | 0.54 | -0.09 | -0.10 |
| C16 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C17 | -1.54 | 0.13 | -0.33 | -0.10 | -0.37 | 0.71 | -0.02 | -0.02 |

Table 20. Impact of “Librarian Involvement in Assignment Design” on students’ GPA and earned credits respectively

For “Library Tour”, combining all participating institutions, students who experienced it, on average earned 1.30 less credits, and had a GPA lower by 0.15, than those who did not experience it in their IL instruction. As shown in Table 21, Cohen’s d indicated that whether or not students experienced “Library Tour”, had a negative but small effect on students’ earned credits and GPA. As for individual institutions, there was some variation in terms of the direction and size of the effect.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Welch’s t Test for the Effect of “Library Tour” on Earned Credits and GPA Respectively | | | | | | | |
| Library Tour (Yes/No) \* Earned Credits in Fall 2019 | | | | Library Tour (Yes/No) \* GPA in Fall 2019 | | | |
| t | sig | mean diff | Cohen's d | t | sig | mean diff | Cohen's d |
| All | -10.19 | 0.00 | -1.30 | -0.19 | -5.06 | 0.00 | -0.15 | -0.15 |
| C1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C2 | 2.87 | 0.00 | 0.71 | 0.18 | 3.57 | 0.00 | 0.22 | 0.22 |
| C3 | -2.89 | 0.01 | -1.83 | -0.59 | -3.46 | 0.00 | -0.53 | -0.63 |
| C4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C5 | -1.93 | 0.07 | -2.45 | -0.58 | -0.96 | 0.35 | -0.35 | -0.31 |
| C6 | 1.10 | 0.27 | 0.39 | 0.11 | 0.14 | 0.89 | 0.01 | 0.01 |
| C8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C9 | 3.87 | 0.00 | 1.36 | 0.34 | 5.25 | 0.00 | 0.54 | 0.53 |
| C10 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C12 | -1.94 | 0.05 | -0.68 | -0.17 | -1.21 | 0.23 | -0.11 | -0.10 |
| C13 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C15 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C16 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C17 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Table 21. Impact of “Library Tour” on students’ GPA and earned credits respectively

To examine the impact of each IL instruction characteristic on the combination of students’ GPA and earned credits, MANOVA was conducted. According to Table 22, Pillai’s trace and partial Eta squared both indicated that none of the six IL instruction characteristics had much of an effect on students’ academic success, measured by their earned credits and GPA combined.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | One-way MANOVA for Each IL Instruction Characteristic’s Effect on Earned Credits and GPA Combined | | | | | | | | | | | | | | | | | |
| Course Integration | | | Online Tutorial or Digital Learning Object | | | Research Guide | | | Librarian(s) Involved in Course Design | | | Librarian(s) Involved in Assignment Design | | | Library Tour | | |
| Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 | Pillai's trace | sig | ηp2 |
| All | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.02 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| C1 | 0.04 | 0.00 | 0.04 | 0.03 | 0.00 | 0.03 | 0.00 | 0.32 | 0.00 | N/A | N/A | N/A | 0.00 | 0.26 | 0.00 | N/A | N/A | N/A |
| C2 | 0.00 | 0.36 | 0.00 | 0.00 | 0.08 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.34 | 0.00 | 0.00 | 0.53 | 0.00 | 0.01 | 0.00 | 0.01 |
| C3 | 0.00 | 0.48 | 0.00 | 0.01 | 0.23 | 0.01 | 0.00 | 0.67 | 0.00 | 0.00 | 0.62 | 0.00 | 0.00 | 0.94 | 0.00 | 0.05 | 0.00 | 0.05 |
| C4 | N/A | N/A | N/A | 0.00 | 0.59 | 0.00 | 0.00 | 0.53 | 0.00 | 0.00 | 0.74 | 0.00 | 0.01 | 0.16 | 0.01 | N/A | N/A | N/A |
| C5 | N/A | N/A | N/A | 0.01 | 0.24 | 0.01 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 |
| C6 | 0.00 | 0.83 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.49 | 0.00 | N/A | N/A | N/A | 0.00 | 0.38 | 0.00 | 0.00 | 0.41 | 0.00 |
| C8 | 0.00 | 0.55 | 0.00 | 0.00 | 0.58 | 0.00 | 0.01 | 0.25 | 0.01 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C9 | N/A | N/A | N/A | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.04 | 0.00 | 0.01 | 0.00 | 0.01 |
| C10 | 0.01 | 0.05 | 0.01 | 0.01 | 0.21 | 0.01 | 0.01 | 0.13 | 0.01 | 0.00 | 0.99 | 0.00 | 0.01 | 0.16 | 0.01 | N/A | N/A | N/A |
| C11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0.01 | 0.61 | 0.01 | 0.01 | 0.61 | 0.01 | N/A | N/A | N/A |
| C12 | 0.00 | 0.90 | 0.00 | 0.00 | 0.29 | 0.00 | 0.01 | 0.18 | 0.01 | N/A | N/A | N/A | 0.01 | 0.17 | 0.01 | 0.01 | 0.13 | 0.01 |
| C13 | N/A | N/A | N/A | 0.02 | 0.00 | 0.02 | 0.02 | 0.01 | 0.02 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C14 | 0.01 | 0.11 | 0.01 | 0.01 | 0.07 | 0.01 | N/A | N/A | N/A | N/A | N/A | N/A | 0.02 | 0.00 | 0.02 | N/A | N/A | N/A |
| C15 | 0.00 | 0.75 | 0.00 | 0.00 | 0.71 | 0.00 | 0.00 | 0.85 | 0.00 | 0.00 | 0.71 | 0.00 | 0.00 | 0.76 | 0.00 | N/A | N/A | N/A |
| C16 | N/A | N/A | N/A | 0.02 | 0.00 | 0.02 | 0.01 | 0.09 | 0.01 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| C17 | N/A | N/A | N/A | 0.00 | 0.22 | 0.00 | 0.00 | 0.93 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.13 | 0.00 | N/A | N/A | N/A |

Table 22. Impact of each IL instruction characteristic on students’ GPA and earned credits combined

# Part I. 4. Conclusion

In this multi-institutional analysis of IL instruction’s impact on students’ academic success, we collected and analyzed data from 17 CSU campuses. Looking at the data collectively from all participating campuses, we learned that about 29% of the 2019-2020 first-year students took courses in fall 2019 (and summer 2019 if applicable) where IL instruction was provided. The effect of IL instruction on students’ academic success, measured in their earned credits and GPA, was negligible. In other words, the fall 2019 earned credits and GPA for students who took courses with IL instruction, were not much different from those who did not.

As for the specific teaching methods and characteristics used in the IL instruction, some had positive effects and some had negative effects on students’ earned credits and GPA, and the effect size was mostly small to negligible. In other words, whether or not students experienced a particular teaching method or characteristic in their IL instruction, did not have much of an impact on their academic success.

Yet, among the individual institutions that participated in the project, there was notable variation in terms of the direction and size of the effect of IL instruction or the teaching methods/characteristics on students’ earned credits or GPA. Still, there was no statistically significant effect size that would be considered large.

In comparison, the GWLA study found that IL instruction significantly impacted students’ first-year GPA and earned credits, but they did not calculate the effect size of the relationship. They reported that on average first-year GPA for students who attended library training was 0.02 points higher than those who did not; and can be expected to complete 1.8 more credit hours than those who did not. Yet, without measuring the effect size, we are not able to tell the strength of the impact, and thus cannot compare our findings with theirs in a meaningful way.

Results of the analysis may be limited by the following factors 1) the data set was primarily from fall 2019, instead of the entire AY 2019-2020 due to the disruptions of COVID-19; so it was smaller than anticipated; 2) there was diversity across the participating institutions with regards to student data and practices of IL instruction.

Although our study did not detect a strong positive effect of IL instruction on students’ academic success, it was necessary to recognize the limitations we faced given the unprecedented challenges posed by COVID-19. We believe this analysis can still serve as a baseline for comparative and longitudinal studies in the future.

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Part II. Methodology

# Part II. 1. Original Plan for Data Collection

In the COLD Student Success Project, we conducted a multi-institutional study to examine the impact of IL instruction on first-year students’ academic success within the California State University (CSU) system. Originally, we had planned to answer the same research questions as in the GWLA study:

* What effect does IL instruction have on student retention?
* What effect does a specific teaching method/characteristic used in IL instruction have on student retention?
* What effect does IL instruction have on students’ academic success?
* What effect does a specific teaching method/characteristic used in IL instruction have on students’ academic success?

The key variables in the research questions were:

* IL instruction
* A specific teaching method
* A specific IL instruction characteristic
* Students’ academic success
* Student retention

To collect data on the above variables, we had decided on the following study population and data collection time frame:

* Study population: 2019-2020 first-year students
* Data collection time frame: 2019-2020 academic year

Our original data collection plan below explains how data for each key variable would be collected for the student population within the data collection time frame. The plan had been developed based on the GWLA study’s procedures. We had also consulted with one of the GWLA study’s authors for clarification and suggestions.

## Part II. 1. 1. Original Data Collection Plan – Key Variables

**IL instruction**

Data for this variable would be whether or not a 2019-2020 first-year student took a course in AY 2019-2020 where IL instruction was provided. IL instruction was defined as IL instructional activities that were provided synchronously in real time for a credit-bearing course listed in the course catalog. If the IL instruction was delivered asynchronously (e.g. via pre-recorded video lectures), or for non-credit-bearing workshops/events, it wouldn’t meet the eligibility criteria for data collection and thus was excluded from the study.

If a student enrolled as a summer-bridge student, meaning that the student started their first semester in summer 2019, their courses in summer 2019 were also examined regarding whether or not IL instruction was provided for those courses, in addition to fall 2019, winter 2020 (for those on the quarter system) and spring 2020.

**A specific teaching method:**

Data for this variable would be whether or not a particular teaching method was used in the IL instruction that was provided for a course taken by a 2019-2020 first-year student in summer 2019 (if applicable), fall 2019, winter 2020 (if applicable), and spring 2020. Four teaching methods were examined (we used the same definitions as in the GWLA study):

* + **Lecture,** defined as "a presentation and/or demonstration, with or without the help of projection of the active website, power-point slides, handouts, etc., with students listening/watching but not actively practicing the methods".
  + **Flipped classroom,** defined as " students were assigned material to complete in advance (modules, videos, tutorials, assignments, etc.), then followed by library instruction which covers the material in greater depth or covers other additional material".
  + **Directed practice,** defined as "as librarian provided demonstrations, students followed along step-by-step on their computers, e.g. using certain search terms and strategies suggested by the librarian".
  + **Active learning**, defined as "students worked in groups or individually to complete in-depth activities and tasks assigned by the librarian; this differs from directed practice in that students complete the tasks independently instead of following the demonstrations step by step".

**A specific IL instruction characteristic:**

Data for this variable would be whether or not a particular IL instruction characteristic was used in the IL instruction that was provided for a course taken by a 2019-2020 first-year student in summer 2019 (if applicable), fall 2019, winter 2020 (if applicable), and spring 2020. Six IL instruction characteristics were examined (we used the same definitions as in the GWLA study):

* + **IL instruction is integrated into the course -** the instruction is specifically designed for the course, instead of being more of a general introduction of library resources/services that is independent of the course objectives/content.
  + **Online tutorials or digital learning objects are integrated as assignment(s) or assessment(s), or used interactively during the instruction** (e.g. students completing the tutorials as part of an in-class activity)
  + **A research guide (or a tab on a research guide) is developed or customized specifically for the course** – this is different from using a pre-existing research guide (or a tab on a research guide) on relevant topics but not purposefully developed or customized for the course.
  + **The IL librarian collaborates with the course instructor in designing the course.**
  + **The IL librarian collaborates with the course instructor to develop at least one credit-bearing assignment for the course.**
  + **An organized class tour of library facilities is provided for the course.**

**Students’ academic success**

Academic success of the 2019-2020 first-year students would be measured by two indicators – their first-year GPA and earned credits. Data for this variable would consist of two sets: 1) 2019-2020 first-year students’ cumulative GPA upon completion of spring 2020; and 2) 2019-2020 first-year students’ earned credits upon completion of spring 2020.

**Student retention**

Student retention refers to the year-to-year retention status of the 2019-2020 first-year students after they complete AY 2019-2020. Data for this variable would be whether or not students have earned a “Yes” on their retention status.

## Part II. 1. 2. Original Data Collection Plan – Data Sources and Additional Variables

Given the types of data need for the study, we had determined that it would come from two sources:

First, the academic library – each participating campus’s library would submit data on how their library provided IL instruction (synchronously, in real time) for credit-bearing course listed in the university course catalog in the following semesters: summer 2019 (if applicable), fall 2019, winter 2020 (if applicable) and spring 2020. If the IL instruction was delivered asynchronously (e.g. via pre-recorded video lectures), or for non-credit-bearing workshops/events, it wouldn’t meet the eligibility criteria for data collection and thus would be excluded from the project.

The unit of analysis in the library’s IL instruction data is an individual credit-bearing course for which synchronous, real-time IL instruction is provided. Such a course usually appears in the university course catalog in the following format – “Course Prefix Course Number Section Number” (e.g. INFO 285 03). Course prefix refers to the three-letter or four-letter department code representing the department that offers the course; course number is a numeric value assigned to the course; and section number is a numeric value representing a specific section of the course when there are multiple sections of the same course.

Thus, for each data record submitted by the library, it would contain data on the following variables:

* Prefix of the course for which the IL instruction is provided
* Number of the course for which the IL instruction is provided
* Section of the course for which the IL instruction is provided
* Semester in which the IL instruction is provided for the course
* Number of students enrolled in the course for which the IL instruction is provided
* Total number of one-shot IL sessions provided for the course
* Total duration of IL instruction (in minutes) provided for the course (if multiple IL sessions are provided, combine the lengths of all the IL sessions)
* Format in which IL instruction is conducted (in person, online or both)
* Role of the person who delivers the IL instruction for the course
* Whether or not each of the four teaching methods is used in the IL instruction for the course (if the IL instruction consists of multiple one-shot sessions, as long as a teaching method is used in one session, it can be marked as Yes)
* Whether or not each of the six characteristics is present in the IL instruction for the course (if the IL instruction consists of multiple one-shot sessions, as long as a characteristic is present in one session, it can be marked as Yes)

Secondly, each campus’s Office of Institutional Research would provide data on the 2019-2020 first-year students. All student data would be anonymized, and the student data would consist of three parts. For each semester in AY 2019-2020, the first part of student data would include students’ earned credits, GPA and demographic data; the second part would comprise the courses students took that semester; and the third part would include year-to-year retention data for 2019-2020 first-year students.

In the first part, each student would have one record containing data on the following variables:

* Campus Name
* Semester (summer 2019, fall 2019, winter 2020, spring 2020) for which the student data is collected
* Student group (2019-2020 first-year students)
* Anonymized student ID
* Student Ethnicity
* Student Sex
* Student's Year of Birth
* The cumulative number credits the student has earned upon completion of that semester
* The number of credits the student has earned in that particular semester
* The cumulative GPA the student has earned upon completion of that semester
* The GPA the student has earned in that particular semester

In the second part, for each student, there would be multiple records, each record representing a course they took in that semester, containing data on the following variables:

* Prefix of the course taken by the student
* Number of the course for taken by the student
* Section of the course for taken by the student
* The student’s grade for the course

In the third part, for each student, there would be one record, representing the student’s retention status after they complete AY 2019-2020. The retention status has two attributes – Yes or No.

# Part II. 2. Data Collection Procedures

Based on the original data collection plan, we proceeded with the following activities to coordinate the data collection at each participating institution.

First, we asked each participating library to name a liaison librarian who would be responsible for collecting their library’s IL instruction data, and working with their Office of Institutional Research in gathering student data.

Then, we held multiple meetings with the liaison librarians and their colleagues from the Office of Institutional Research, to explain the data collection process, the types of data to be collected, and in what format. These meetings were very helpful in communicating the project’s data needs to individuals responsible for each participating institution’s data collection. We received great input from the meeting participants, which helped us clarify the definitions for some of the variables to ensure a more clear and consistent understanding about what each variable entails and how to collect data for it across all participating institutions.

To further help the liaison librarians and their colleagues from the Office of Institutional Research better visualize what types of data the project needs, we provided following documents to them to illustrate the types of data to be collected:

* An explanation about the data collection time frame, as well as variable labels and definitions was provided for both the IL instruction data and the student data.
* A sample data output was provided to illustrate what the data file should look like for both the IL instruction data and the student data. Figures 1 - 3 are screenshots of the sample data output files.

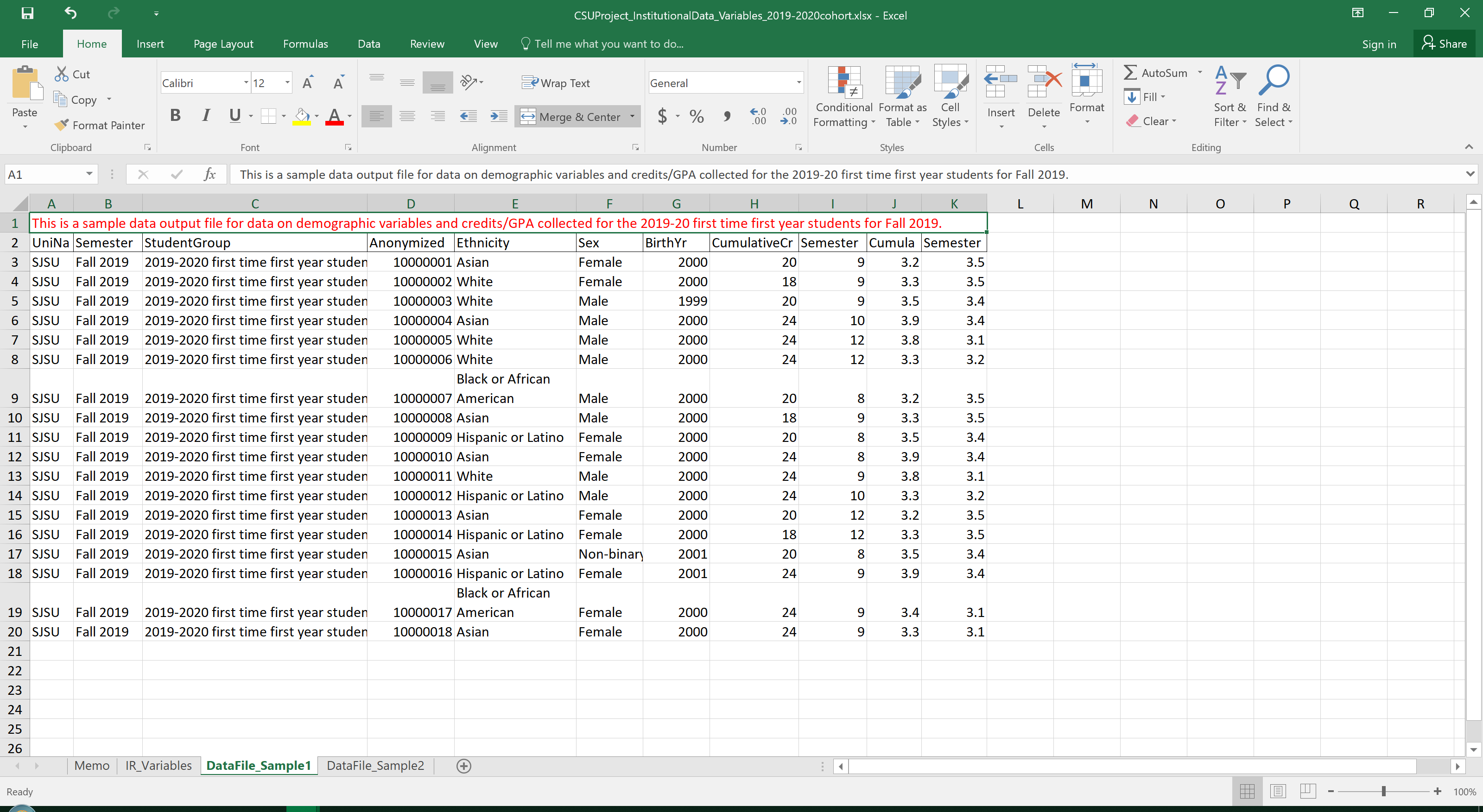


Figure 1. Sample data output for students’ GPA, earned credits and demographic information using hypothetical data

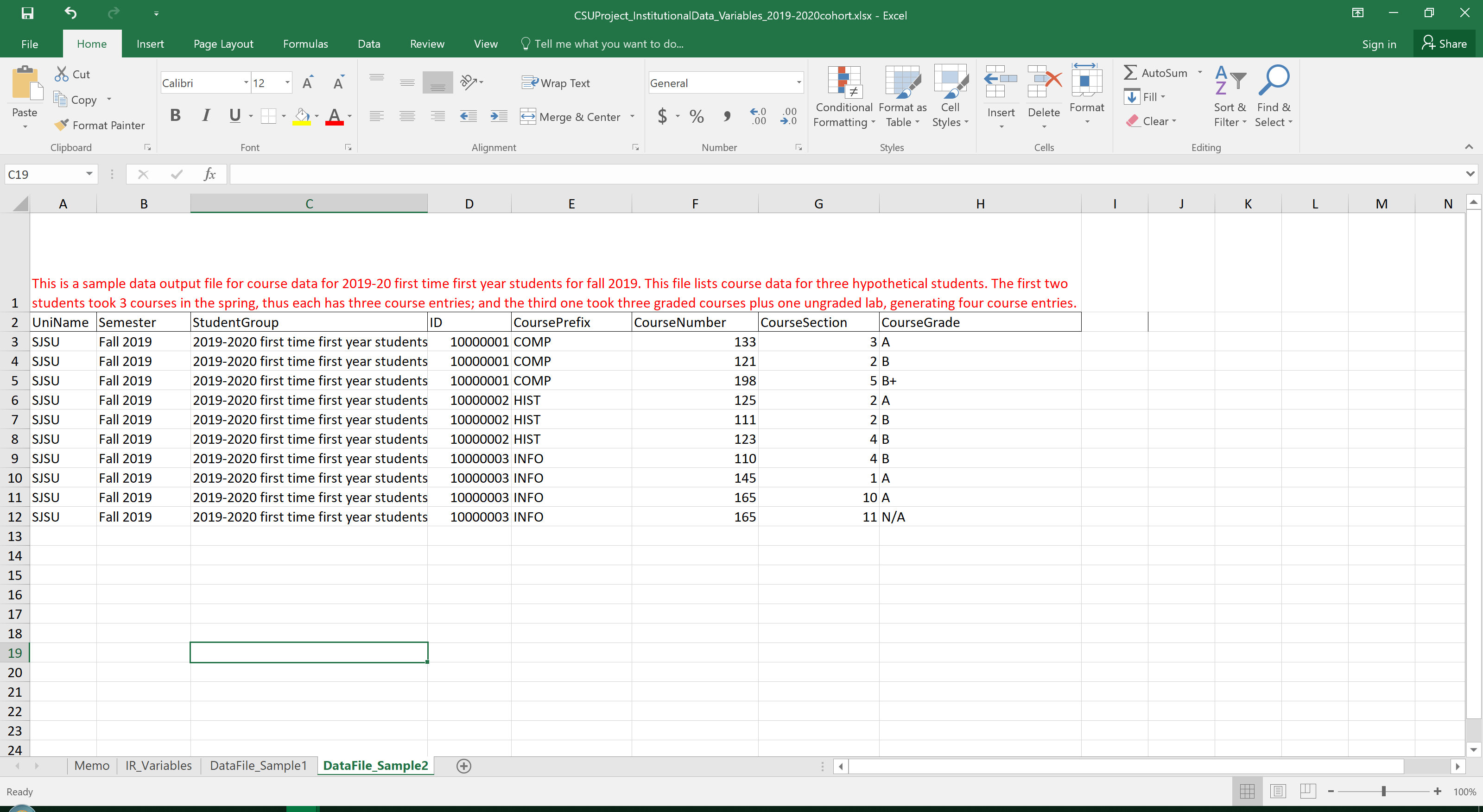


Figure 2. Sample data output for students’ course data using hypothetical data

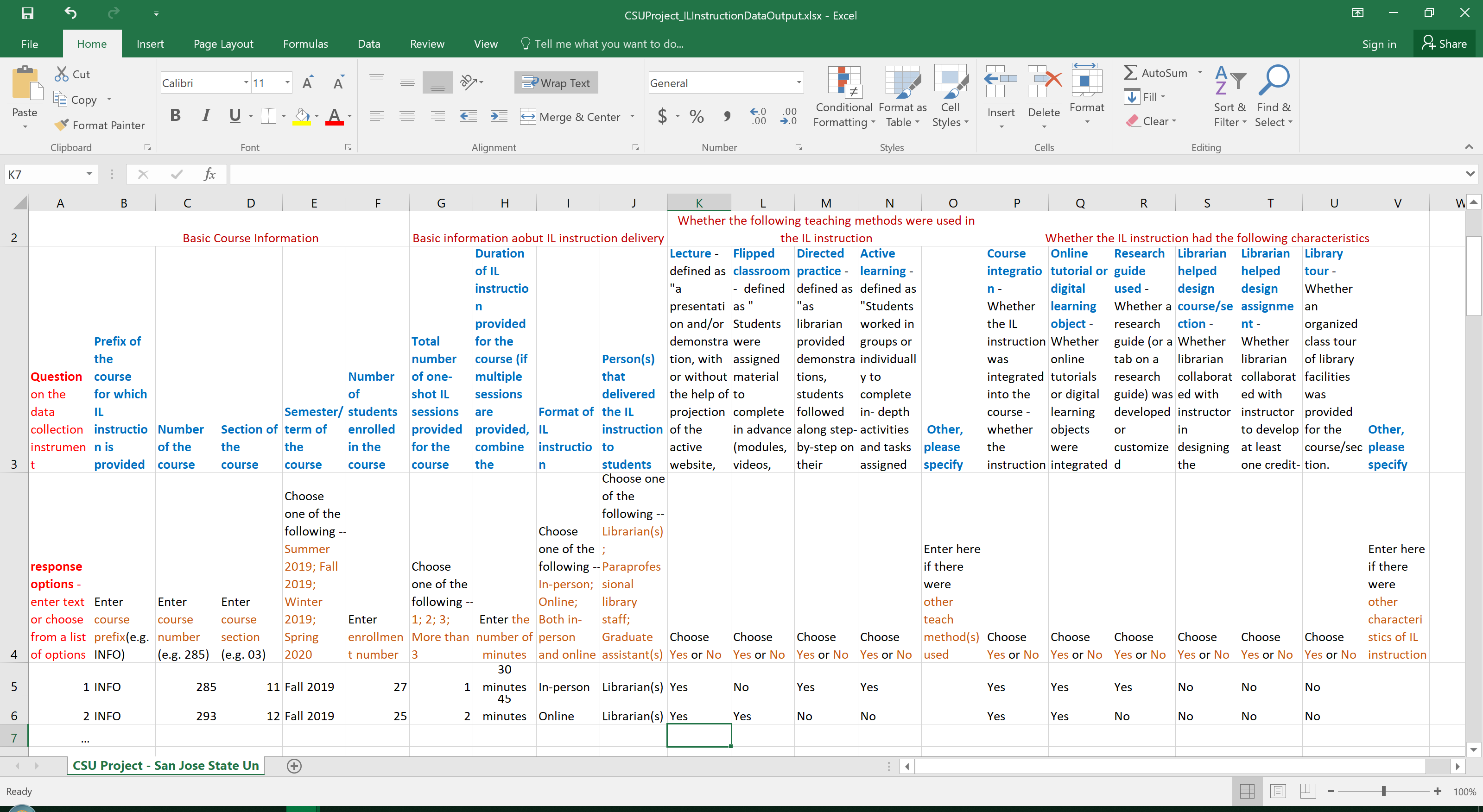


Figure 3. Sample data output for IL instruction data using hypothetical data

* A sample data collection form (Figure 4) was provided to help liaison librarians create their own data collection forms to generate the data in the format needed by the project.

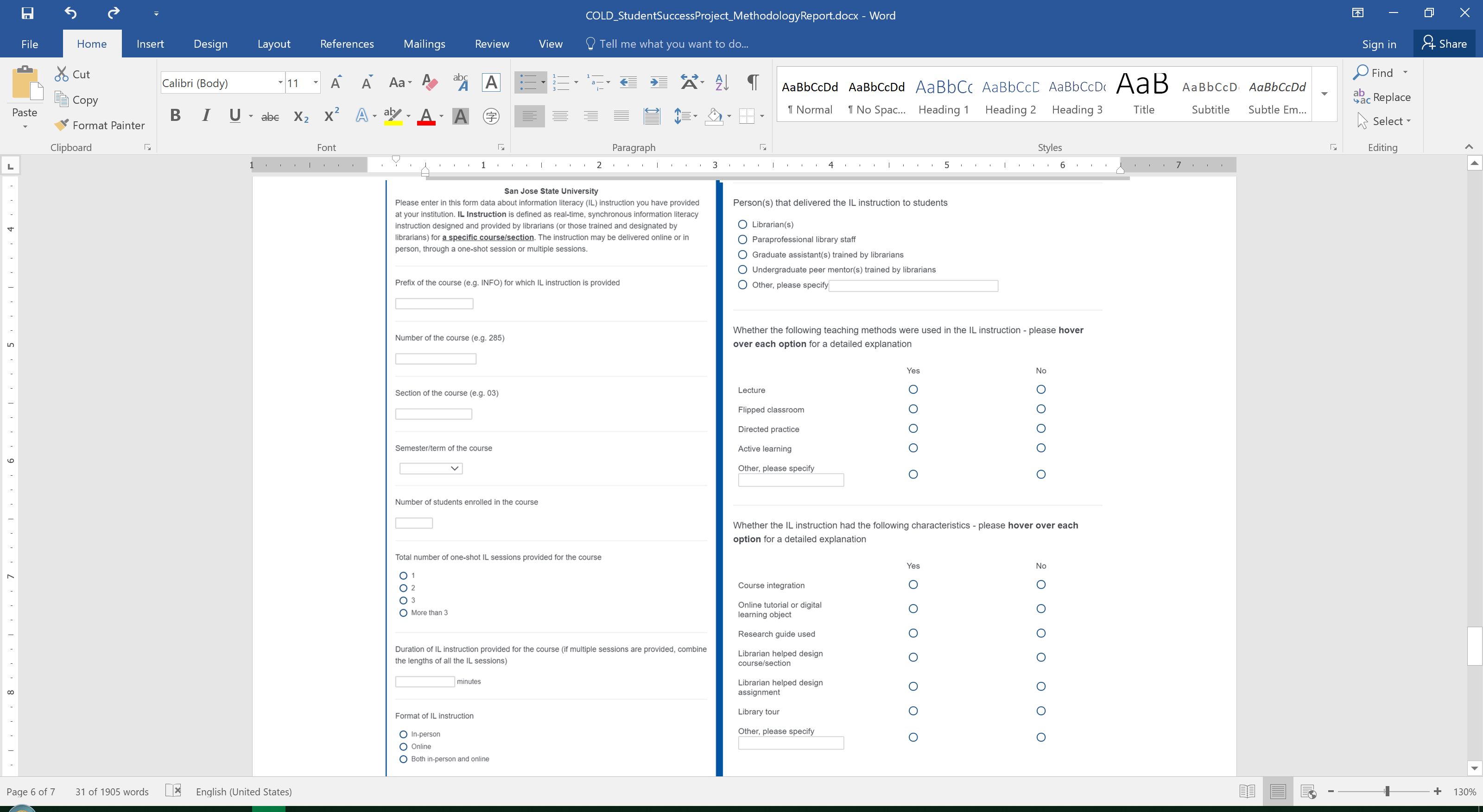


Figure 4. Sample data collection form for IL instruction data

With regards to IRB approval, we first received approval from the co-PIs’ home institution. Since the project would only collect anonymized data with no involvement of human subjects, we qualified for exemption. Then we sent our IRB approval letter and other related materials (e.g. co-PI’s certificates of research ethics training, the narrative describing the project) to all participating institutions, whose own IRB responses can be grouped into three categories:

* Approval was granted after reviewing our IRB materials (*this was the case for the majority of the participating institutions*).
* They requested a cooperative research agreement or reliance agreement from us before granting approval.
* They requested that the co-PIs register with them and take their required research ethics training before granting approval.

In order for participating institutions to submit their data in a secure way, we used the co-PIs’ home institution’s Google Drive to create a subfolder for each participating campus, and provided the liaison librarian from that campus with access to that subfolder, so he/she can upload their campus’s data files. Then, the co-PIs would download the files from there.

We pilot tested our data collection instruments in spring 2019 – several participating institutions submitted their IL instruction data and student data (using 2018-2019 first-year student as the pilot group) from spring 2019, and it helped us identify potential issues that may arise from the data collection process.

# Part II. 3. The COVID-19 Pandemic and Data Collection Adjustments

The unprecedented COVID-19 pandemic broke out in the middle of spring 2020, and caused a multitude of disruptions. As far as our project was concerned, we worried that these disruptions (e.g. sudden shift to learning mode that students might not be familiar with; losing wages and access to housing; mental health struggles, as established in the literature) would introduce a host of confounding variables that would taint the validity of student data collected in spring 2020 as well as the 2019-2020 year-to-year retention data. Thus, we had to adjust our strategies and exclude both the spring 2020 student data and the retention data from the study, and only examined the fall 2019 student data to answer the revised research questions:

* **What effect does IL instruction have on students’ academic success?**
* **What effect does a specific teaching method/characteristic used in IL instruction have on students’ academic success?**

Because of the adjustments, we had to use different data points for students’ academic success – instead of examining 2019-2020 first-year students’ cumulative GPA and earned credits upon completion of spring 2020, we would look at their GAP and earned credits in fall 2019 as measurement of their academic success.

# Part II. 4. Data Collection Issues

During the data collection process, we felt that the following issues were worth mentioning so that others interested in replicating such a multi-institutional study could be aware of them.

* Quite a number of IL instruction data files contained multiple entries for the same course. We had to return those files to the participating campus, explaining that each course (e.g. LIBR 285-03) should have only one data record, where we capture all the characteristics of the IL instruction provided for that course. If multiple IL instruction sessions were provided for that course, we combine the number of sessions and the duration of the sessions (measured in minutes) and note the total amount in that record; as for the teaching methods/characteristics, as long as each method/characteristic appeared in one of the multiple IL instruction sessions, we mark Yes for it in that record.
* Some student data files had issues and had to be returned as well. For example, the entire GPA data was missing; the data was misplaced; there were student IDs that existed in the course data file but not in the GPA/earned credits/demographics data file.
* The pandemic made it harder for participating institutions to meet the data submission deadlines. We had to push the deadlines several times to accommodate the needs of different institutions.

Despite these issues, all of the participating institutions were responsive and cooperative in addressing them, and we were very grateful for their hard work in helping us with data collection and data cleaning.

# Part II. 5. Conclusion

It had been a tremendous undertaking to plan, implement and adjust the data collection procedures for the COLD Student Success Project. We would like to thank all the participating institutions for a great team effort.

Part III. Information Literacy Instruction: A Multi-institutional Comparison

# Part III. 1. Introduction

In the COLD Student Success Project, participating institutions collected data on their library’s information literacy (IL) instruction activities in AY 2019-2020. Part III of the report presents a comparative view of how IL instruction was provided in fall 2019 and in spring 2020 across the libraries that participated in this project. It will help further the cross-institution understanding of IL instruction at the California State University system. Particularly, as the COVID-19 pandemic broke out in the midst of the spring 2020 semester, such a comparative view can help reflect how the pandemic may have impacted the library’s IL instruction efforts.

In this project, each participating library’s IL instruction data was only collected for activities where IL instruction is provided synchronously in real time for a credit-bearing course listed in the course catalog. If the IL instruction was delivered asynchronously (e.g. via pre-recorded video lectures), or for non-credit-bearing workshops/events, it wouldn’t meet the eligibility criteria for data collection and thus would be excluded from the project.

The unit of analysis in the data collection for IL instruction activities is an individual credit-bearing course for which synchronous, real-time IL instruction is provided. Such a course usually appears in the university course catalog in the following format – “Course Prefix Course Number Section Number” (e.g. INFO 285 03). Course prefix refers to the three-letter or four-letter department code representing the department that offers the course; course number is a numeric value assigned to the course; and section number is a numeric value representing a specific section of the course when there are multiple sections of the same course.

For each course where IL instruction was provided, the participating library would record data on the following variables:

* **Number of IL instruction sessions** - the total number of one-shot IL sessions provided for the course
* **Duration of IL instruction in minutes** - the length of IL instruction provided for the course; if multiple sessions are provided, the lengths of all the IL sessions are combined.
* **IL instruction format** - the format in which IL instruction is conducted, which could be in-person, online or both.
* **Provider of the IL instruction** - The person(s) who deliver the IL instruction for the course.
* **Whether or not each of the following teaching methods is used in the IL instruction:**
  + **Lecture,** defined as "a presentation and/or demonstration, with or without the help of projection of the active website, power-point slides, handouts, etc., with students listening/watching but not actively practicing the methods".
  + **Flipped classroom,** defined as " students were assigned material to complete in advance (modules, videos, tutorials, assignments, etc.), then followed by library instruction which covers the material in greater depth or covers other additional material".
  + **Directed practice,** defined as "as librarian provided demonstrations, students followed along step-by-step on their computers, e.g. using certain search terms and strategies suggested by the librarian".
  + **Active learning**, defined as "students worked in groups or individually to complete in- depth activities and tasks assigned by the librarian; this differs from directed practice in that students complete the tasks independently instead of following the demonstrations step by step".
* **Whether or not each of the following characteristics is present in the IL instruction:**
  + **IL instruction is integrated into the course -** the instruction is specifically designed for the course, instead of being more of a general introduction of library resources/services that is independent of the course objectives/content.
  + **Online tutorials or digital learning objects are integrated as assignment(s) or assessment(s), or used interactively during the instruction** (e.g. students completing the tutorials as part of an in-class activity)
  + **A research guide (or a tab on a research guide) is developed or customized specifically for the course** – this is different from using a pre-existing research guide (or a tab on a research guide) on relevant topics but not purposefully developed or customized for the course.
  + **The IL librarian collaborates with the course instructor in designing the course.**
  + **The IL librarian collaborates with the course instructor to develop at least one credit-bearing assignment for the course.**
  + **An organized class tour of library facilities is provided for the course.**

# Part III. 2. Results

In fall 2019, the number of courses for which synchronous, real-time IL instruction was provided ranges from 26 to 311 across the participating institutions. In spring 2020, the number ranges from 4 to 223. As shown in Figure 5, there is a notable decrease in the number from fall 2019 to spring 2020. All participants, except for one, experienced varying degrees of drop in the number of courses where the library provided synchronous, real-time IL instruction. One likely explanation could be the disruptions caused by the COVID-19 outbreak that started in Mid-March of 2020.

Figure 5. Number of courses for which IL instruction was provided in fall 2019 and spring 2020

For each course, the synchronous, real-time IL instruction may be provided in a single one-shot session or in multiple sessions. Table 23 records at each participating institution the percentage of courses that received their IL instruction in 1 one-shot session, in 2 one-shot sessions, or in 3 or more one-shot sessions. In both fall 2019 and spring 2020, the majority of the courses received 1 one-shot session of IL instruction.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CampusID | Number of One-shot Sessions in FA19 | | | Number of One-shot Sessions in SP20 | | |
| 1 | 2 | 3 or More | 1 | 2 | 3 or More |
| C1 | 80.2% | 12.9% | 7.0% | 88.3% | 10.0% | 1.7% |
| C2 | 85.9% | 12.1% | 2.0% | 89.6% | 10.4% | N/A |
| C3 | 72.5% | 23.2% | 4.3% | 88.6% | 9.1% | 2.3% |
| C4 | 89.2% | 7.2% | 3.6% | 97.4% | N/A | 2.6% |
| C5 | 86.8% | 8.8% | 4.4% | 72.0% | 8.0% | 20.0% |
| C6 | 97.8% | 2.2% | N/A | 97.6% | 2.4% | N/A |
| C7 | 42.3% | 30.8% | 26.9% | 60.0% | 30.0% | 10.0% |
| C8 | 89.2% | 10.8% | N/A | 93.7% | 6.3% | N/A |
| C9 | 68.5% | 29.3% | 2.2% | 86.1% | 13.9% | N/A |
| C10 | 87.7% | 9.0% | 3.3% | 90.4% | 7.6% | 1.9% |
| C11 | 100.0% | N/A | N/A | 100.0% | N/A | N/A |
| C12 | 69.1% | 20.2% | 10.7% | 70.6% | 11.8% | 17.7% |
| C13 | 87.8% | 6.9% | 5.3% | 92.6% | 2.9% | 4.4% |
| C14 | 90.6% | 7.2% | 1.7% | 91.3% | 7.0% | 1.7% |
| C15 | 82.5% | 14.1% | 3.4% | 87.4% | 12.1% | 0.4% |
| C16 | 86.9% | 6.6% | 6.6% | 86.9% | 4.0% | 9.1% |

Table 23. Percentage of courses that received different number of one-shot sessions in IL instruction

Figure 6 shows the average duration of the synchronous, real-time IL instruction a course received in fall 2019 and spring 2020 across the participating institutions. For most of the participants, there was not much of a change from fall 2019 to spring 2020 in terms of the average length of IL instruction, which fell mostly between 50 to 100 minutes. It is worth noting that one institution averaged over 300 minutes in IL instruction for a course in fall 2019, and over 180 minutes in spring 2020.

Figure 6. Average of IL instruction duration for a course (measured in minutes)

For each course, the format in which the synchronous, real-time IL instruction is delivered includes in-person, online, and both in-person and online. Table 24 records at each participating institution the percentage of courses that received their IL instruction in different formats. In fall 2019, the majority of the libraries delivered their IL instruction in person; and in spring 2020, although the in-person format was still the most popular format of IL instruction, there was a notable increase in online IL instruction. Figure 7 presents a comparative view of the percentage of courses that received IL instruction either entirely online or partially online in fall 2019 and spring 2020, and the growth is obvious. This is likely a result of the sudden shift to online education due to the COVID-19 pandemic that broke out in March 2020.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CampusID | IL Instruction Format in FA19 | | | IL Instruction Format in SP20 | | |
| In-person | Online | Both In-person and Online | In-person | Online | Both In-person and Online |
| C1 | 100.00% | N/A | N/A | 95.00% | 5.00% | N/A |
| C2 | 99.00% | 1.00% | N/A | 85.40% | 12.50% | 2.10% |
| C3 | 97.10% | N/A | 2.90% | 88.60% | 11.40% | N/A |
| C4 | 96.40% | 3.60% | N/A | 94.90% | 2.60% | 2.60% |
| C5 | 92.60% | 7.40% | N/A | 60.00% | 36.00% | 4.00% |
| C6 | 98.50% | 0.70% | 0.70% | 92.90% | 6.00% | 1.20% |
| C7 | 100.00% | N/A | N/A | 80.00% | 10.00% | 10.00% |
| C8 | 99.10% | 0.90% | N/A | 93.70% | 5.10% | 1.30% |
| C9 | 98.10% | 1.90% | N/A | 81.50% | 15.60% | 2.90% |
| C10 | 100.00% | N/A | N/A | 97.50% | 1.90% | 0.60% |
| C11 | 98.00% | N/A | 2.00% | N/A | 100.00% | N/A |
| C12 | 97.90% | 2.10% | N/A | 91.20% | 5.90% | 2.90% |
| C13 | 96.90% | 0.80% | 2.30% | 76.50% | 23.50% | N/A |
| C14 | 100.00% | N/A | N/A | 74.80% | 20.90% | 4.30% |
| C15 | 98.00% | 2.00% | N/A | 96.90% | 2.20% | 0.90% |
| C16 | 98.50% | 1.50% | N/A | 75.80% | 13.10% | 11.10% |

Table 24. Percentage of courses that received different formats of IL instruction

Figure 7. Percentage of courses that received IL instruction entirely or partially in the online format

Regarding the person that provides the synchronous, real-time IL instruction to each course, Table 25 indicates that in both fall 2019 and spring 2020, the majority of the courses received their IL instruction from librarians. Other providers of IL instruction include paraprofessional library staff, course instructors, undergraduate peer mentors trained by librarians and technology trainers.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FA19 | | | | | | SP20 | | | |
| Campus ID | Librarian(s) | Para-professional Library Staff | Librarian(s) and Para-professional Library Staff | Course Instructor | Librarian(s) with Assistance from Course Instructor | Undergrad Peer Mentor(s) Trained by Librarian(s) | Librarian(s) | Para-professional Library Staff | Librarian(s) with assistance from Course Instructor | Librarian(s) &Technology Trainer |
| C1 | 99.0% | 1.0% | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C2 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C3 | 97.1% | 1.4% | 1.4% | N/A | N/A | N/A | 97.7% | 2.3% | N/A | N/A |
| C4 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C5 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C6 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C7 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C8 | 97.3% | N/A | N/A | 2.7% | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C9 | 98.1% | 1.9% | N/A | N/A | N/A | N/A | 96.0% | 4.0% | N/A | N/A |
| C10 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C11 | 79.6% | N/A | N/A | N/A | N/A | 20.4% | 100.0% | N/A | N/A | N/A |
| C12 | 98.9% | 1.1% | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C13 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C14 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |
| C15 | 94.3% | N/A | N/A | 0.3% | 5.4% | N/A | 92.8% | N/A | 6.7% | 0.4% |
| C16 | 100.0% | N/A | N/A | N/A | N/A | N/A | 100.0% | N/A | N/A | N/A |

Table 25. Percentage of courses that received IL instruction from people in different roles

In terms of the teaching method “Lecture”, defined as "a presentation and/or demonstration, with or without the help of projection of the active website, power-point slides, handouts, etc., with students listening/watching but not actively practicing the methods", Figure 8 shows the percentage of courses where this method was used in their IL instruction in both fall 2019 and spring 2020 across all participating institutions. At 9 participating institutions, more than 90% of the courses that received IL instruction experienced this method either in fall 2019 or in spring 2020, or both, suggesting that this is a popular teaching method for IL instruction. There is not a consistent pattern with regards to the semester-to-semester change across the institutions. Some institutions experienced an increase in the percentage of courses for which “lecture” was used in IL instruction, and some experienced a drop, and some others remained more or less the same.

Figure 8. Percentage of courses where the “Lecture” method was used IL instruction

Flipped classroom, defined as "students were assigned material to complete in advance (modules, videos, tutorials, assignments, etc.), then followed by library instruction which covers the material in greater depth or covers other additional material", was a far less popular teaching method. Figure 9 depicts for each participating institution the percentage of courses where this method was used in their IL instruction in fall 2019 and in spring 2020. At 7 participating institutions, this percentage was less than 10% in either semester. For the rest of the participants, the percentage never exceeded 25%. There is not a consistent pattern with regards to the semester-to-semester change across the institutions. Some institutions experienced an increase in the percentage of courses for which “flipped classroom” was used in IL instruction, and some experienced a drop, and some others remained more or less the same.

Figure 9. Percentage of courses where the “Flipped classroom” method was used IL instruction

Directed practice, defined as "as librarian provided demonstrations, students followed along step-by-step on their computers, e.g. using certain search terms and strategies suggested by the librarian", was a teaching method where the participating institutions showed more variation. As shown in Figure 10, the percentage of courses for which the IL instruction employed the “directed practice” method ranged from 3.5% to 72.8% in fall 2019, and 8.7% to 77.9% in spring 2020 across the participating institutions. There is not a consistent pattern with regards to the semester-to-semester change across the institutions. Some institutions experienced an increase in the percentage of courses for which “directed practice” was used in IL instruction, and some experienced a drop, and some others remained more or less the same.

Figure 10. Percentage of courses where the “Directed practice” method was used IL instruction

Active learning, defined as "students worked in groups or individually to complete in- depth activities and tasks assigned by the librarian; this differs from directed practice in that students complete the tasks independently instead of following the demonstrations step by step", is another teaching method that showed notable variation across the participating institutions. As indicated in Figure 11, the percentage of courses where the “active learning” method was used IL instruction ranged from 26.5% to 99.0% in fall 2019, and from 0.0% to 98.9 in spring 2020. There is not a consistent pattern with regards to the semester-to-semester change across the institutions. Some institutions experienced an increase in the percentage of courses for which “active learning” was used in IL instruction, and some experienced a drop, and some others remained more or less the same.

Figure 11. Percentage of courses where the “Active learning” method was used IL instruction

Regarding whether or not the IL instruction is integrated into the course, that is, whether or not the instruction is specifically designed for the course, instead of being more of a general introduction of library resources/services that is independent of the course objectives/content, Figure 12 shows that the integration occurred for more than 80% of the courses in either fall 2019 or spring 2020 at 12 participating institutions, indicating that this was a prevalent characteristic in IL instruction. Meanwhile, 13 participants experienced less than 10% in terms of semester-to-semester change in the percentage of courses where the IL instruction was integrated, suggesting that “course integration” was a stable characteristic in IL instruction.

Figure 12. Percentage of courses where the IL instruction was integrated into the course

When it comes to whether online tutorials or digital learning objects are integrated as assignment(s) or assessment(s), or used interactively during the instruction (e.g. students completing the tutorials as part of an in-class activity), Figure 13 suggests that it is not a popular characteristic in IL instruction. At 11 participating institutions, only 20% or less courses received IL instruction with this characteristic in fall 2019 and spring 2020. As for the semester-to-semester change, there is not a consistent pattern across the institutions. Some institutions experienced an increase in the percentage of courses for which online tutorials or digital learning objects were integrated in IL instruction, and some experienced a drop, and some others remained more or less the same.

Figure 13. Percentage of courses where “Online tutorials or digital learning objects” was integrated in IL instruction

In IL instruction, whether or not a research guide (or a tab on a research guide) is developed or customized specifically for the course, is a characteristic where much variation was found. As indicated in Figure 14, the percentage of courses where a research guide (or a tab on a research guide) was developed or customized specifically for the course ranged from 2.8% to 73.1% in fall 2019, and from 8.3% to 87.5% in spring 2020. There is not a consistent pattern with regards to the semester-to-semester change across the institutions. Some institutions experienced an increase in the percentage of courses where the IL instruction included a purposefully developed or customized research guide, and some experienced a drop, and some others remained more or less the same.

Figure 14. Percentage of courses where a research guide (or a tab on a research guide) is developed or customized specifically for the course

Not many IL librarians collaborated with the course instructor in designing the course for which they provided IL instruction. As shown in Figure 15, in either semester, at more than half of the participating institutions, only less than 5% of the courses involved the IL librarian in their course design. Overall the percentage of courses where the IL librarian collaborated with the course instructor in course design was higher in fall 2019 than in spring 2020.

Figure 15. Percentage of courses where the IL librarian was involved in course design

IL librarians’ involvement in the course was more salient in the area of assignment design. More IL librarians collaborated with the course instructor to develop credit-bearing assignment(s) for the course where they provided synchronous real-time IL instruction. As shown in Figure 16, in fall 2019, the percentage of courses with librarian involvement in assignment design reached over 40% at two institutions, and between 20% and 40% at four institutions. Overall the percentage of courses where the IL librarian collaborated with the course instructor in assignment design was higher in fall 2019 than in spring 2020.

Figure 16. Percentage of courses where the IL librarian was involved in assignment design

Offering an organized class tour of library facilities is not a popular characteristic in IL instruction. Figure 17 demonstrates for each participating institution the percentage of courses for which a library tour was provided as part of the IL instruction. At all but five institutions, less than 5% of the courses experienced library tour in their IL instruction in both fall 2019 and spring 2020.

Figure 17. Percentage of courses where a library tour was provided

# Part III. 3. Conclusion

The IL instruction data collected for this project has shown a decrease in the total number of courses that received synchronous real-time IL instruction from fall 2019 to spring 2020, but an increase in the percentage of courses where the IL instruction was delivered entirely or partially online, as a likely result of pandemic-induced disruptions. In terms of teaching methods used in IL instruction, “Lecture” was the most popular, and “Flipped classroom” was the least. “Directed practice” and “Active learning” had much variation across the participating institutions. With regards to the characteristics of the IL instruction, the most prevalent characteristic was “Course integration”, that is, the instruction is specifically designed for the course, instead of being more of a general introduction of library resources/services that is independent of the course objectives/content. IL librarians were not involved in collaborative course design as they were in collaborative assignment design, and “Library tour” was rarely offered as part of the IL instruction.

This analysis may serve as a starting point to generate more conversations about IL instruction across institutions and encourage further explorations of the teaching methods and IL instruction characteristics where notable differences exist between institutions.