**University of Utah**

**Department of Geography**

Learning Outcomes Assessment

5-Year Interim Report, Fall 2017-Spring 2022

6/29/22

Prepared by Tim Collins, Director of Undergraduate Studies, with input members of the Undergraduate Committee and the Department Chair

1. **Program Mission and Background**

The mission of the University of Utah Department of Geography is to generate high quality research and teaching focused on the interactions between the human and physical environment. We are inspired to produce important scientific advances in our core research areas (including health and urban geography, hazards and security, climate change and paleoenvironment, and geographic information science and remote sensing), to provide professional and community service, and to prepare students for in-demand careers in Geography and related fields. We offer two undergraduate degrees with separate learning outcomes:

* BS/BA in Geography
* BS in Geographic Information Science

The BS/BA in Geography is a well-established degree. The BS in Geographic Information Science (BSGIS) is a recently established degree. Less than five BSGIS majors have graduated from the program thus far, and there are currently 17 declared BSGIS majors. We have begun to implement our LOA for the BSGIS degree and we anticipate having enough graduates from the program to report meaningful LOA reporting by Spring 2023.

In this report, we present the programmatic learning outcomes and the assessment procedures established for each of the two degrees. We provide assessment results and conclusions for the BS/BA in Geography only, because too few students have engaged in the BSGIS assessment process to draw reliable conclusions regarding learning outcomes thus far.

1. **Programmatic Learning Outcomes**

**BS/BA in Geography**

1. Basic understanding of the scientific discovery process in the discipline of geography
2. Basic understanding of at least one geographic subfield
3. Ability to think spatially and conduct basic spatial analysis
4. Ability to critically understand knowledge communicated in written and cartographic forms

**BS in Geographic Information Science**

1. Students completing the BS degree should demonstrate fundamental knowledge and comprehension of the major geographic concepts, theoretical perspectives, historical trends, and analytical methods for the creation and utilization of geographic data and information, geospatial databases, geospatial modeling and statistics. Students should demonstrate a fluency in the supporting data sources and technologies, including satellite imagery, GPS, computer programming and statistics.
2. Students completing a baccalaureate degree should be grounded in geographic information theory and methodology being able to design and execute research and GIS implementation projects. The goal is higher education in GIS, not simply technical training.
3. Application of GIS specific content and skills, teamwork skills, project planning and management skills, and career preparation.
4. **Assessment Procedures**

**BS/BA in Geography**

1. Basic understanding of the scientific discovery process in the discipline of geography

*Assessment Procedure*: Canvas quizzes on the scientific discovery process students take in GEOG 3270 *Biogeography*, GEOG 3400 *Population Geography*, and GEOG 3210 *Global Climate Change*. These are upper division content courses, at least one of which all BS/BA in Geography degree-seeking students must take.

1. Basic understanding of at least one geographic subfield

*Assessment Procedure*: Canvas quizzes applicable to physical or human geography that students take in either GEOG 3270 *Biogeography* (physical) or GEOG 3400 *Population Geography* (human). These are upper division content courses, one of which all BS/BA in Geography degree-seeking students must take.

1. Ability to think spatially and conduct basic spatial analysis

*Assessment Procedure*: Canvas quiz on spatial analysis literacy that students take in GEOG 3020 *Geographical Analysis*.

1. Ability to critically understand knowledge communicated in written and cartographic forms

*Assessment Procedure*: Canvas quizzes to assess ability to critically understand knowledge communicated in written and cartographic forms in GEOG 3400 *Population Geography* and GEOG 3100 *Introduction to Geographic Information Systems and Cartography* (a required course for all BS/BA in Geography degree-seeking students). GEOG 3100 began in Fall 2018; however, the same assessment was previously conducted in Fall 2017 in GEOG 3140 *Introduction to Geographic Information Systems* (which was replaced in the curriculum by GEOG 3100).

Data collection for the BS/BA in Geography assessment is conducted in the final weeks of each course. Students respond to multiple choice and short answer questions in Canvas. The questions—developed by the course instructors, the Chair, and the Undergraduate Committee—are standardized across the sections and terms of each course. Students are given credit as they complete questions for the assessment. Each instructor implementing assessment questions creates a brief report, which includes the raw data and a summary of results, and submits it to the Director of Undergraduate Studies.

Between Fall 2017 and Spring 2022, 21 courses were assessed using standardized procedures. The selected courses were taught by a mix of adjunct and tenure line faculty, which reflects the mix of teaching assignments in the program. Table 1 summarizes the courses included in the learning outcomes assessment.

As described in the Department of Geography LOA 3-Year Interim Report (Fall 2017-Spring 2020), results from the assessments implemented in GEOG 3400 during the Fall semesters of 2017-2019 contradicted results from the assessments implemented in other courses with respect to learning outcomes 1, 2, and 4. Moreover, for each of the learning outcomes assessed using items administered in GEOG 3400, students exhibited dramatic variation in mastery. A review of GEOG 3400 assessment items that students struggled on indicated that they were problematic and thus yielded unreliable results. In collaboration with the Undergraduate Director (Tim Collins), the GEOG 3400 lead instructor (Andrew Linke) revised the assessment instrument prior to the Fall 2020 semester. Unfortunately, the adjunct instructor of GEOG 3400 in Fall 2021 semester mistakenly implemented the unrevised version of the GEOG 3400 assessment. Thus, in addition to the assessments implemented in other courses, this report relies only on results from the GEOG 3400 assessment conducted in the Fall semester of 2020.

**Table 1.** Summary and schedule of courses included in the assessment report

|  |  |  |  |
| --- | --- | --- | --- |
| **Course** | **Course Name** | **Learning Outcomes Assessed** | **Term** |
| **Fa 2017** | **Sp 2018** | **Fa 2018** | **Sp 2019** | **Fa 2019** | **Sp 2020** | **Fa 2020** | **Sp****2021** | **Fa 2021** | **Sp****2022** |
| **3020** | *Geographical Analysis* | 3 |  | CAR |  | CAR |  | CAR |  | CAR |  | CAR |
| **3100** | *Intro. GIS & Cart.* | 4 | TEN |  | TEN |  | TEN | CAR | TEN | ADJ | TEN | ADJ |
| **3210** | *Global Climate Change* | 1 |  | CAR |  |  |  | ADJ |  | TEN | TEN | TEN |
| **3270** | *Biogeography* | 1 & 2 |  |  |  | CAR |  |  |  |  |  | CAR |
| **3400** | *Population Geography* | 1, 2 & 4 |  |  |  |  |  |  | TEN |  |  |  |
| ADJ stands for adjunct faculty, CAR, stands for career line faculty, and TEN stands for tenure line faculty. |

**BS in Geographic Information Science**

1. Students completing the BS degree should demonstrate fundamental knowledge and comprehension of the major geographic concepts, theoretical perspectives, historical trends, and analytical methods for the creation and utilization of geographic data and information, geospatial databases, geospatial modeling and statistics. Students should demonstrate a fluency in the supporting data sources and technologies, including satellite imagery, GPS, computer programming and statistics.
2. Students completing a baccalaureate degree should be grounded in geographic information theory and methodology being able to design and execute research and GIS implementation projects. The goal is higher education in GIS, not simply technical training.
3. Application of GIS specific content and skills, teamwork skills, project planning and management skills, and career preparation.

*Assessment Procedures*: Each student creates a portfolio of products from their BSGIS coursework that features their skill development in reference to each of the learning outcomes. Students will present their portfolios in GEOG 5161 *Capstone in Geographic Information Science*, which all BSGIS students take after completion of other coursework as a final step to completing the degree.The grading rubric used to assess the portfolios in GEOG 5161 is aligned with the BSGIS learning outcomes, such that the distribution of rubric sub-item scores and overall portfolio grades informs the LOA. In addition, each BSGIS student completes a self-assessment of their knowledge and skills gained for each learning outcome in Canvas for credit as part of GEOG 5161. Since less than five students have completed the BSGIS degree thus far, we do not report LOA results for this program here.

1. **Assessment Results**

We present LOA results below for each learning outcome separately, based on assessments of each course and term. We also present aggregated results for each course across all terms of study as well as across all courses and terms for each learning outcome. Please see Appendix 1 for details on test items for each course assessment by learning outcome.

***Do students demonstrate a basic understanding of the scientific discovery process in the discipline of geography?* (BS/BA in Geography Learning Outcome 1)**

Tables 2-4 present results for the Learning Outcome 1 assessment. Students provided correct responses to 81% of the GEOG 3210 test items across the two terms of study, which demonstrates a solid basic understanding of the scientific discovery process in geography (Table 2). Note the percentage of correct answers for Spring 2020 (78%) was down from Spring 2018 (86%). The reduced score is likely attributable in part to the movement of the class to an online format mid-semester as a protective measure against the 2020 COVID-19 pandemic, as well as the addition of a fifth item (Question 5), which a relatively lower percentage of students answered correctly (70%). The percentage of correct answers rebounded to 80% plus for the Spring and Fall 2021 semesters.

**Table 2.** Results for Learning Outcome 1: GEOG 3210 *Global Climate Change* (*n*=411)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test item** | **Spring 2018** | **Spring 2020** | **Spring 2021** | **Fall 2021** | **Total % correct** |
| **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** |
| **Q 1** | 70 | 1 | 98 | 104 | 28 | 79 | 129 | 17 | 88 | 53 | 9 | 85 | 87 |
| **Q 2** | 62 | 9 | 87 | 107 | 25 | 81 | 109 | 37 | 75 | 45 | 17 | 73 | 79 |
| **Q 3** | 46 | 25 | 64 | 91 | 41 | 69 | 141 | 5 | 97 | 58 | 4 | 94 | 82 |
| **Q 4** | 67 | 4 | 94 | 118 | 14 | 89 | 117 | 29 | 80 | 44 | 18 | 71 | 84 |
| **Q 5\*** | -- | -- | -- | 93 | 39 | 70 | 113 | 33 | 77 | 48 | 14 | 77 | 75 |
| **Total** | 245 | 39 | **86** | 513 | 147 | **78** | 609 | 121 | **83** | 248 | 62 | **80** | **81** |

\*Not included in the Spring 2018 assessment

For the two terms of assessment for GEOG 3270, students provided correct responses to 81% of the test items (Table 3). Question 1—for which students demonstrated the poorest understanding (60% correct)—focused on the concept of inductive reasoning.

**Table 3.** Results for Learning Outcome 1: GEOG 3270 *Biogeography* (*n*=40)

|  |  |  |  |
| --- | --- | --- | --- |
| **Test item** | **Spring 2019** | **Spring 2022** | **Total % correct** |
| **# correct** | **# incorrect** | **% correct** | **# correct** | **# incorrect** | **% correct** |
| **Question 1** | 12 | 8 | 60 | 12 | 8 | 60 | 60 |
| **Question 2** | 17 | 3 | 85 | 19 | 1 | 95 | 90 |
| **Question 3** | 17 | 3 | 85 | 20 | 0 | 100 | 93 |
| **Total** | 46 | 14 | **77** | 51 | 9 | **85** | **81** |

Students in GEOG 3400 answered 71% of Learning Outcome 1 test items correctly during the one term in which the new assessment instrument was used. There was some variation in student performance across the test items. While only 48% of students answered Question 3 correctly, 100% of students responded correctly to Question 2.**Table 4.** Results for Learning Outcome 1: GEOG 3400 *Population Geography* (*n*=21)

|  |  |
| --- | --- |
| **Test item** | **Fall 2020** |
| **# correct** | **# incorrect** | **% correct** |
| **Question 1** | 13 | 8 | 62 |
| **Question 2** | 21 | 0 | 100 |
| **Question 3** | 10 | 11 | 48 |
| **Question 4** | 14 | 7 | 67 |
| **Question 5** | 17 | 4 | 81 |
| **Total** | 75 | 30 | **71** |

To provide a composite measure across the courses and terms, we divided the number of correct responses (1,787) by the number of questions asked (2,209) to all students who participated in the Learning Outcome 1 assessment. Based on that measure, students answered 81% of Learning Outcome 1 assessment questions correctly across the five-year period of study.

***Do students demonstrate a basic understanding of at least one geographic subfield?* (BS/BA in Geography Learning Outcome 2)**

Tables 5 and 6 present results for the Learning Outcome 2 assessment. For the two terms of assessment for GEOG 3270, students provided correct responses to 89% of the test items (Table 5). Based on that measure, students in that course demonstrated very good basic understanding of a geographic subfield (biogeography in this case).

**Table 5.** Results for Learning Outcome 2: GEOG 3270 *Biogeography* (*n*=40)

|  |  |  |  |
| --- | --- | --- | --- |
| **Test item** | **Spring 2019** | **Spring 2022** | **Total % correct** |
| **# correct** | **# incorrect** | **% correct** | **# correct** | **# incorrect** | **% correct** |
| **Question 1** | 20 | 0 | 100 | 20 | 0 | 100 | 100 |
| **Question 2** | 19 | 1 | 95 | 19 | 1 | 95 | 95 |
| **Question 3** | 17 | 3 | 85 | 16 | 4 | 80 | 83 |
| **Question 4** | 18 | 2 | 90 | 14 | 6 | 70 | 80 |
| **Total** | 74 | 6 | **93** | 69 | 11 | **86** | **89** |

For GEOG 3400, students answered 83% of test items correctly during the one term of study in which the revised assessment instrument was used (Table 6). This indicated a solid basic understanding of another geographic subfield (population geography).

**Table 6.** Results for Learning Outcome 2: GEOG 3400 *Population Geography* (*n*=21)

|  |  |
| --- | --- |
| **Test item** | **Fall 2020** |
| **# correct** | **# incorrect** | **% correct** |
| **Question 1** | 15 | 6 | 71 |
| **Question 2** | 20 | 1 | 95 |
| **Question 3** | 17 | 4 | 81 |
| **Total** | 52 | 11 | **83** |

To provide a composite measure across courses and terms, we divided the number of correct responses (195) by the number of questions asked (223) to all students who participated in the Learning Outcome 2 assessment. Based on that measure, students answered 87% of Learning Outcome 2 assessment questions correctly across the study period.***Do students demonstrate the ability to think spatially and conduct basic spatial analysis?* (BS/BA in Geography Learning Outcome 3)**

Table 7 presents results for the Learning Outcome 3 assessment. GEOG 3020 is the only course used to assess Learning Outcome 3. Students provided correct responses to 82% of the GEOG 3020 test items across the five terms of study, which reflects a good ability to think spatially and conduct basic spatial analysis. Note that the percentage of correct answers for Spring 2020 (76%) was down from Spring 2019 and Spring 2018 (both 83%), and that the percentage of correct answers then bounced back to 85% and 84% for the Spring 2021 and Spring 2022 semesters, respectively. The worse performance by students during Spring 2020 is likely attributable to the transition of the class to an online format mid-semester as a protective measure during the onset of the COVID-19 pandemic. According to the course instructor (Tim Edgar), moving to an online format reduced classroom contact time and students’ engagement with the course material.

**Table 7.** Results for Learning Outcome 3: GEOG 3020 *Geographical Analysis* (*n*=126)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test item** | **Spring 2018** | **Spring 2019** | **Spring 2020**  | **Spring 2021** | **Spring 2022** | **Total % correct** |
| **# c.** | **# i.** | **% c.** | **# c.** | **# i.** | **% c.** | **# c.** | **# i.** | **% c.** | **# c.** | **# i.** | **% c.** | **# c.** | **# i.** | **% c.** |
| **Q 1** | 30 | 13 | 70 | 37 | 8 | 82 | 27 | 11 | 71 | 19 | 6 | 76 | 27 | 8 | 77 | 75 |
| **Q 2** | 42 | 1 | 98 | 44 | 1 | 98 | 37 | 1 | 97 | 24 | 1 | 96 | 35 | 0 | 100 | 98 |
| **Q 3** | 39 | 4 | 91 | 38 | 7 | 84 | 31 | 7 | 82 | 21 | 4 | 84 | 30 | 5 | 86 | 85 |
| **Q 4** | 42 | 1 | 98 | 44 | 1 | 98 | 34 | 4 | 89 | 25 | 0 | 100 | 34 | 1 | 97 | 96 |
| **Q 5** | 41 | 2 | 95 | 44 | 1 | 98 | 37 | 1 | 97 | 25 | 0 | 100 | 34 | 1 | 97 | 97 |
| **Q 6** | 28 | 15 | 65 | 29 | 16 | 64 | 15 | 23 | 39 | 16 | 9 | 64 | 28 | 7 | 80 | 62 |
| **Q 7** | 24 | 19 | 56 | 25 | 20 | 56 | 17 | 21 | 45 | 15 | 10 | 60 | 20 | 15 | 57 | 54 |
| **Q 8** | 41 | 2 | 95 | 37 | 8 | 82 | 32 | 6 | 84 | 24 | 1 | 96 | 28 | 7 | 80 | 87 |
| **Total** | 287 | 57 | **83** | 298 | 62 | **83** | 230 | 74 | **76** | 169 | 31 | **85** | 236 | 44 | **84** | **82** |

c. = correct; i. = incorrect

***Do students demonstrate the ability to critically understand knowledge communicated in written and cartographic forms?* (BS/BA in Geography Learning Outcome 4)**

Tables 8 and 9 present results for the Learning Outcome 4 assessment. Students provided correct responses to 88% of the GEOG 3100 test items across eight terms of study, which generally demonstrates well-developed ability to critically understand knowledge communicated in cartographic form (Table 8). Note that the percentage of correct answers for Spring 2020 (80%) was down from Fall 2019 (88%), Fall 2018 (84%), and Fall 2017 (90%), and that the percentage of correct answers then bounced back to during the Fall 2020 (92%), Spring 2021 (85%), Fall 2021 (93%), and Spring 2022 (92%) semesters. The reduced score for Spring 2020 is likely attributable to the transition of the class to an online format mid-semester. Moving to an online format impacted classroom and lab contact time, which is important to the learning process in this course.

**Table 8.** Results for Learning Outcome 4: GEOG 3100 *Introduction to GIS and Cartography* (*n*=404)1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test item** | **Fall 2017** | **Fall 2018** | **Fall 2019** | **Spring 20202** |
| **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** |
| **Q 1** | 47 | 5 | 91 | 42 | 3 | 94 | 50 | 2 | 96 | 46 | 1 | 98 |
| **Q 2** | 52 | 0 | 100 | 45 | 0 | 100 | 52 | 0 | 100 | 23 | 0 | 100 |
| **Q 3** | 52 | 0 | 100 | 45 | 0 | 100 | 52 | 0 | 100 | 21 | 1 | 95 |
| **Q 4** | 47 | 5 | 90 | 41 | 4 | 92 | 47 | 5 | 90 | 24 | 2 | 92 |
| **Q 5** | 50 | 2 | 97 | 43 | 2 | 96 | 50 | 2 | 97 | 31 | 0 | 100 |
| **Q 6** | 45 | 7 | 86 | 36 | 9 | 80 | 42 | 10 | 80 | 31 | 12 | 72 |
| **Q 7** | 44 | 8 | 84 | 44 | 45 | 97 | 47 | 5 | 91 | 40 | 6 | 87 |
| **Q 8** | 52 | 0 | 100 | 45 | 0 | 100 | 51 | 1 | 98 | 48 | 1 | 98 |
| **Q 9** | 41 | 11 | 78 | 39 | 6 | 87 | 39 | 13 | 75 | 35 | 14 | 71 |
| **Q 10** | 47 | 5 | 90 | 36 | 9 | 80 | 42 | 10 | 80 | 41 | 8 | 84 |
| **Q 11** | 42 | 10 | 80 | 37 | 8 | 82 | 39 | 13 | 74 | 31 | 18 | 63 |
| **Q 12** | 45 | 7 | 87 | 35 | 10 | 78 | 43 | 9 | 82 | 19 | 30 | 39 |
| **Q 13** | 44 | 8 | 84 | 39 | 6 | 86 | 41 | 11 | 78 | 34 | 15 | 69 |
| **Total** | 608 | 68 | **90** | 527 | 102 | **84** | 595 | 81 | **88** | 424 | 108 | **80** |

**Table 8.** *Continued*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test item** | **Fall 20202** | **Spring 20212** | **Fall 20212** | **Spring 20222** | **Total % correct** |
| **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** | **# cor.** | **# incor.** | **% cor.** |
| **Q 1** | 56 | 1 | 98 | 38 | 2 | 95 | 60 | 0 | 100 | 45 | 4 | 92 |  |
| **Q 2** | 28 | 0 | 100 | 23 | 1 | 96 | 31 | 1 | 97 | 19 | 3 | 86 |  |
| **Q 3** | 23 | 0 | 100 | 18 | 0 | 100 | 26 | 0 | 100 | 17 | 2 | 89 |  |
| **Q 4** | 16 | 1 | 94 | 13 | 1 | 93 | 30 | 0 | 100 | 20 | 2 | 91 |  |
| **Q 5** | 32 | 1 | 97 | 19 | 2 | 90 | 26 | 0 | 100 | 30 | 1 | 97 |  |
| **Q 6** | 31 | 16 | 66 | 27 | 8 | 77 | 36 | 16 | 69 | 32 | 9 | 78 |  |
| **Q 7** | 47 | 6 | 89 | 30 | 8 | 79 | 52 | 5 | 91 | 40 | 3 | 93 |  |
| **Q 8** | 56 | 0 | 100 | 36 | 0 | 100 | 59 | 0 | 100 | 48 | 0 | 100 |  |
| **Q 93** | -- | -- | -- | 32 | 8 | 80 | 56 | 4 | 93 | 45 | 4 | 92 |  |
| **Q 103** | -- | -- | -- | 32 | 8 | 80 | 56 | 4 | 93 | 45 | 4 | 92 |  |
| **Q 113** | -- | -- | -- | 32 | 8 | 80 | 56 | 4 | 93 | 45 | 4 | 92 |  |
| **Q 123** | -- | -- | -- | 32 | 8 | 80 | 56 | 4 | 93 | 45 | 4 | 92 |  |
| **Q 133** | -- | -- | -- | 32 | 8 | 80 | 56 | 4 | 93 | 45 | 4 | 92 |  |
| **Total** | 289 | 25 | **92** | 364 | 62 | **85** | 600 | 42 | **93** | 476 | 44 | **92** | **88** |

1 In Fall 2017, the assessment was administered in GEOG 3140 *Introduction to GIS*.

2 Each test item has a unique number of respondents as per instructor reported results.

3 Q9-Q13 were not included in the assessment during the Fall 2020 term at the instructor’s discretion.

GEOG 3400 students answered 89% of test items correctly in Fall 2020 (Table 9). This indicates very good ability to critically understand knowledge communicated in written and cartographic form.

**Table 9.** Results for Learning Outcome 4: GEOG 3400 *Population Geography* (*n*=54)

|  |  |
| --- | --- |
| **Test item** | **Fall 2020** |
| **# correct** | **# incorrect** | **% correct** |
| **Question 1** | 14 | 7 | 67 |
| **Question 2** | 21 | 0 | 100 |
| **Question 3** | 21 | 0 | 100 |
| **Total** | 56 | 7 | **89** |

To provide a composite measure across courses and terms, we divided the number of correct responses (3,939) by the number of questions asked (4,429) to all students who participated in the Learning Outcome 4 assessment. Based on that measure, students answered 88% of Learning Outcome 4 assessment questions correctly across the study period.

1. **Summary and Recommendations**

**Summary**

The Geography BS/BA LOA process was implemented satisfactorily and students who were assessed demonstrated success in terms of meeting the expected learning outcomes. The percentage of students correctly answering the test items was in the 71-93% range across the courses included in the LOA. Over the five-year period of study, students answered a high percentage of questions correctly with respect to each of the four learning outcomes: 81% for Learning Outcome 1, 87% for Learning Outcome 2, 82% for Learning Outcome 3, and 88% for Learning Outcome 4.

**Recommendations**

The LOA process implemented for the Geography BS/BA degree enables adequate assessment of student progress toward achieving expected learning outcomes. Moreover, LOA results from the five-year assessment period indicate that coursework in the degree program enables students to achieve the expected learning outcomes. An appropriate LOA process has been established for the BS in Geographic Information Science. However, too few students have completed that degree program to support reliable assessment yet. We have two recommendations to bolster LOA of these degree programs:

First, additional oversight is warranted to ensure that adjunct instructors implement the LOA process properly in their course. The LOA process was not implemented correctly in one adjunct-led section of GEOG 3400 during the five-year assessment period.

Second, given the small number of BSGIS students currently, a qualitative approach to augment LOA for that program should be considered. Semi-structured interviews or focus groups with the smaller number of majors in the program might provide useful information to support the LOA process.

**APPENDIX I. Canvas questions for the assessment by learning outcome and course**

**Learning Outcome 1**

**GEOG 3210 *Global Climate Change***

**Question 1**

1. The tilt of the earth, currently 23.45 degrees, is a result of collisions with large bodies during the formation of the planets in the solar system. Which of the following statements are true?
	1. The earth’s tilt is responsible for our seasons.
	2. The earth’s tilt has little relationship to climate.
	3. The earth’s tilt changes over time and those changes influence the amount and timing of solar insolation.
	4. Both a and c are correct.

**Question 2**

1. The difference between climate and weather is often misunderstood by the public. The definition of weather is:
	1. The same as climate, but longer term.
	2. Day to day metrics of environmental conditions of a specific place.
	3. A one-year average of environmental conditions.
	4. A description of what you see and feel outside on any given day.

**Question 3**

1. If a system responds to a change in input by moving further away from its equilibrium condition, what type of feedback has occurred?
	1. Positive.
	2. Negative.
	3. Neutral.
	4. Not enough information to tell.

**Question 4**

1. The increase in number and area of meltwater ponds in the Arctic is an example of:
	1. Negative feedback, because the ponds reflect more sunlight than ice and thereby absorb less energy.
	2. Positive feedback, as the melt ice freezes it increases the area of ice.
	3. Positive feedback, because the ponds absorb more solar energy than the ice did.
	4. Negative feedback, as the ice melts the water freezes, increasing the amount of ice.

**Question 5 [Not included in the Spring 2018 assessment]**

1. **A hypothesis can be tested:**
	1. By collecting additional data.
	2. By consulting with other scientists.
	3. By narrowing the focus of the study.
	4. None of these.

**GEOG 3270 *Biogeography***

**Question 1**

* + - 1. An approach in the application of the scientific method where generalizations are drawn from a collection of observations is termed a(n) \_\_\_\_\_ approach.

Correct answer: Inductive

**Question 2**

* + - 1. A hypothesis can be tested:

Correct answer: By collecting additional data

**Question 3**

* + - 1. A scientific theory is falsified if:

Correct answer: Any data reject it

**GEOG 3400 *Population Geography***

**Question 1**

1. A census is an important data resource that geographers use to understand populations. When geographers analyze existing census data, we classify it as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ data analysis. (*fill in the blank*)
2. Primary
3. Secondary
4. Tertiary
5. Longitudinal

**Question 2**

1. Which of the following is NOT a measurement used in the ‘basic population geography formula’ that estimates the population of a region?
	1. Births (eg. Total Fertility Rate)
	2. Stage of Epidemiological transition (eg. early or late).
	3. Deaths (eg. Crude Death Rate)
	4. Migration (eg. Net Migration)

**Question 3**

1. Due to the effect of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a population geographer conducting statistical analysis may reach different conclusions about education, health, or employment among people living in states or counties than those in an entire country. (*fill in the blank*)
2. Cartography
3. Hierarchical scale (level)
4. Exponential population growth
5. Per capita metrics

**Question 4**

1. Population geographers measure the presence and effects of diseases in several ways. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the best measurement of disease severity. (*fill in the blank*).
	1. Morbidity rate
	2. Proportionate mortality rate
	3. Crude death rate
	4. Case fatality rate

**Question 5**

1. Historical birth and death rate data show that world regions (e.g. Sub-Saharan Africa, Asia, the Americas) advance through the epidemiological transition identically. True or false?
	1. True
	2. False

**Learning Outcome 2**

**GEOG 3270 *Biogeography***

**Question 1**

* + - 1. The highest (most inclusive) taxonomic level in the Linnaean Classification system of the terms in the list below is:

Correct answer: Kingdom

**Question 2**

* + - 1. Disjunct (discontinuous) geographic distributions of closely related species can be explained by:

Correct answer: Land bridges & plate tectonics.

**Question 3**

* + - 1. The study of biogeography examines:

Correct answer: The abiotic and biotic influences on the distribution of organism through time and across space.

**Question 4**

* + - 1. With respect to air, water, and material resources, which of the following is true?

Correct answer: A leaf is an open system.

**GEOG 3400 *Population Geography***

**Question 1**

1. Total Fertility Rate is an aggregate statistic predicting:
2. The time that it takes for the population in a given region to double
3. The expected number of children women in a population would have if they survive childbearing years and current age-specific fertility rates remain constant.
4. The number of live births within a population per 1,000 women
5. The number of women of child-bearing age who achieve their desired family size

**Question 2**

1. According to demographic transition theory, natural population decline within a country or society will take place:
2. In stage one, where birth rates and death rates are both high
3. In stage five, assuming that migration into that area does not take place
4. Population size will never decline because population grows exponentially
5. Where poverty is common

**Question 3**

1. Which of the following called into question central themes of Malthusian “population bomb” and natural resource scarcity research of the 1960-80s?
2. “Green revolution” advances in agricultural productivity
3. Technological innovation that reduced reliance on non-renewable natural resources
4. Institutions that allowed for effective sharing of common resources
5. All of the above

**Learning Outcome 3**

**GEOG 3020 *Geographical Analysis***

**Question 1**

1. The transfer of conclusions from spatially aggregated analysis to smaller areas or to the individual can lead to:
2. ecological fallacy
3. problem of boundary delineation
4. Modifiable Area Unit Problem
5. gerrymandering

**Question 2**

1. The value of various descriptive statistics can be affected by:
2. alteration of the external boundary of a study area
3. modification of internal boundaries
4. change in the scale of spatial resolution by using a different level of aggregation
5. all of these

**Question 3**

1. Which of the following point distributions has the largest absolute dispersion?

B

D

C

A

1. A
2. B
3. C
4. D

**Question 4**

1. Which of the following terms is NOT used to describe the spatial distribution of point and area patterns?
	1. aggregated
	2. clustered
	3. dispersed
	4. random

**Question 5**

1. A random point pattern is one in which:
	1. any point is equally likely to occur at any location and the position of any point is not affected by the position of any other point
	2. many points are concentrated close together and there are large areas that contain very few, if any, points
	3. every point is as far from all of its neighbors as possible
	4. the points are highly dispersed from each other

**Question 6**

1. Which of the following is NOT a definition of spatial autocorrelation?
	1. correlation of one variable with a second variable over space
	2. the dependence of occurrence of an event in one location on the occurrence of an event in a neighboring location
	3. the correlation between an observation and the neighbouring observations
	4. the extent to which characteristics at one location are similar to those nearby

**Question 7**

1. Which of the following is FALSE?
2. the degree to which a geographic variable is correlated with itself tends to increase with increasing distance
3. global tests may not find a significant level of global autocorrelation, but significant local clusters may still exist
4. the only two valid measures of point distributions are the number of occurrences (the number of points) in the pattern, and the respective geographic locations (location of points relative to one another)
5. all of these are FALSE

**Question 8**

1. Which of the following is most accurate regarding the three figures below?



 Figure 1 Figure 2 Figure 3

1. Figure 1 best represents a pattern of *no spatial autocorrelation*, Figure 2 best represents a pattern of *positive spatial autocorrelation*, and Figure 3 best represents a pattern of *negative spatial autocorrelation*
2. Figure 1 best represents a pattern of *positive spatial autocorrelation*, Figure 2 best represents a pattern of *no spatial autocorrelation*, and Figure 3 best represents a pattern of *negative spatial autocorrelation*
3. Figure 1 best represents a pattern of *negative spatial autocorrelation*, Figure 2 best represents a pattern of *no spatial autocorrelation*, and Figure 3 best represents a pattern of *positive spatial autocorrelation*
4. Figure 1 best represents a pattern of *no spatial autocorrelation*, Figure 2 best represents a pattern of *negative spatial autocorrelation*, and Figure 3 best represents a pattern of *positive spatial autocorrelation*

**Learning Outcome 4**

**GEOG 3100 *Introduction to Geographic Information Systems and Cartography***

Short Answer

**Question 1**

1. A poorly designed map can ruin the presentation of good information. Describe the lifespan of a map from planning to printing and the basic decisions that have to be along the way.

**Question 2**

2. (A) List all basic map components.

(B) Although it never hurts to include all of them on every map, discuss a situation where it would be reasonable to not include all of the components- be specific.

**Question 3**

3. Map projections distort what aspects of real world features and spatial relationships?  A frequently used projection is the Mercator, where is most distorted with this projection and why?

**Question 4**

4. List and describe the four general classes of map projections. Which one would be best used for a map of declining levels arctic sea ice?

**Question 5**

5. Explain when you might use single symbol, graduated colors, or proportional symbols.

Multiple Choice

**Question 6**

6. A \_\_\_\_\_\_\_\_\_\_\_\_\_ coordinate system uses a 3-d spherical surface to define locations, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ coordinate system then translates them to a 2-d surface.

1. geoid, datum
2. datum, projected
3. projected, geographic
4. geographic, projected
5. conic, planar

**Question 7**

7. If you would like a continuous surface, but only have values at discrete points, what process would you use to spatially distribute those values?

1. interpolation
2. vector analysis
3. raster analysis
4. kernel mapping

**Question 8**

8. Spatial autocorrelation, also known as Tobler’s first law of geography, is the observation that-

1. Murphy's law is true
2. Everything is related, but near things are more related than distant things
3. Supply and demand drive economic and environmental forces
4. Distance does not play in a role in how things are related

Fill in the Blank

**Questions 9-13 (A-E). See questions below.**

9 (A)

10 (B)
11 (C)

12 (D)

12 (E)

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**GEOG 3400 *Population Geography***

**Question 1**

1. Of the following options, the population pyramid below most closely characterizes a country in which phase of the demographic transition

****

1. Stage one
2. Stage two
3. Stage three
4. Stage four

**Question 2**

1. A graphical representation of the migration ‘gravity model’ shows:
2. The relatively small number of population centers in mountainous rural regions
3. Flows of migration among cities as a function of distances between cities and the population sizes of cities
4. The substantial recent growth of informal settlements/slums in the developing world
5. That the likelihood of permanent migration is a function of age

**Question 3**

1. Country-by-country, global maps of fertility (eg. Crude Birth Rate) and mortality (eg. Crude Death Rate) reveal:
2. Divergent patterns where fertility is low in regions with high mortality
3. High fertility in wealthy countries where families can afford more children and live longer
4. General overlap between high fertility and high mortality in developing countries
5. Powerful effects of climate region