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| **Assurance of Student Learning Report****2022-2023** |
| Ogden College of Science and Engineering | Department of Earth Environmental and Atmospheric Sciences |
| Undergraduate Certificate in Geographic Information Systems (#174) |
| Amy Nemon |
| ***Is this an online program***? [ ]  Yes [x]  No | Please make sure the Program Learning Outcomes listed match those in CourseLeaf . Indicate verification here  [x]  Yes, they match |

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages. Add more Outcomes as needed.*** |
| **Program Student Learning Outcome 1:** Students will be able to organize GIS data and communicate effectively through mapping using accepted principles of cartographic design and spatial reference systems. |
| **Instrument 1** | Direct: Analysis of capstone project in GISC 316 (Fundamentals of GIS). For the capstone project, students must customize a projection for their study area, create a correctly normalized quantitative map of the region that demonstrates an understanding of numerical classification, and develop an attractive map layout that effectively communicates their data set’s theme while adhering to accepted principles of cartographic design. A comprehensive rubric is used to evaluate the capstone project. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 2:** Students can demonstrate proficiency in the quantitative and qualitative spatial analysis and critical thinking through written and oral communication. |
| **Instrument 1** | Direct: Applied spatial data synthesis and analysis projects (both written and oral) administered in GISC 317 (Geographic Information Systems). A series of five applied projects is completed in the course. All data analysis and projects completed in the course are from real-world data sets. GISC 317 is the final 300-level GISC course for all certificate students, so examining the artifacts of this course provides the best overall reflection of students’ basic ability to synthesize and analyze data quantitively and spatially. A comprehensive rubric is used to evaluate each of the five projects. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 3:** Students will demonstrate proficiency in GIS project planning, design, and implementation, as well as mastery of advanced geoprocessing and modeling techniques. |
| **Instrument 1** | Direct: Analysis of capstone project in GISC 417 (GIS Analysis and Modeling). A comprehensive rubric is used to evaluate the capstone project. |
| **Instrument 2** | Direct: Analysis of six applied projects in GISC 419 (GIS Programming). A comprehensive rubric is used to evaluate all six projects. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Assessment Cycle Plan:**  |
| Each course, in the certificate program, is taught at least once in an academic year. These courses are continually asessed each academic year. |

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| **Program Student Learning Outcome 1** |
| **Program Student Learning Outcome**  | Students will be able to organize GIS data and communicate effectively through mapping using accepted principles of cartographic design and spatial reference systems. |
| **Measurement Instrument 1**  | Direct measures of student learning: Analysis of capstone project in GISC 316 (Fundamentals of GIS). For the capstone project, students must customize a projection for their study area, create a correctly normalized quantitative map of the region that demonstrates an understanding of numerical classification, and develop an attractive map layout that effectively communicates their data set’s theme while adhering to accepted principles of cartographic design. |
| **Criteria for Student Success** | The overall score on the capstone project will be 70% or higher. |
| **Program Success Target for this Measurement** | The goal is for the class average to be 70% or higher on the assessment. | **Percent of Program Achieving Target** | The class average was 83.94%. (n=17) |
| **Methods**  | A comprehensive rubric (see end of this report) is used to evaluate the capstone project. The total score of students taught in Fall 2022 averaged. For n=17 students, the average capstone project score was 83.94% |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| The addition of the capstone project in GISC316 was undertaken in the 2022-2023 academic year in response to feedback from more advanced GIS certificate courses that students were not sufficiently mastering projection and cartographic design skills. Based on this year’s results, the redesign of GISC316 seems to have been successful. The follow-up will be to ensure that all sections of GIS 316 use the newly developed capstone project. GISC 316 has been revamped for the new academic year and there will be changes to the assessment in the next academic year. |

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| **Program Student Learning Outcome 2** |
| **Program Student Learning Outcome**  | Students can demonstrate proficiency in the quantitative and qualitative spatial analysis and critical thinking through written and oral communication. |
| **Measurement Instrument 1** | Direct: Applied spatial data synthesis and analysis projects (both written and oral) administered in GISC 317 (Geographic Information Systems). A series of five applied projects is completed in the course. All data analysis and projects completed in the course are from real-world data sets. GISC 317 is the final 300-level GISC course for all certificate students, so examining the artifacts of this course provides the best overall reflection of students’ basic ability to synthesize and analyze data quantitively and spatially. |
| **Criteria for Student Success** | Students will have earned a grade of 70% or higher on a series of five applied projects to demonstrate proficiency in quantitative and spatial data analysis, critical thinking, and written communication. (see grading criteria at end of document). |
| **Program Success Target for this Measurement** | The goal is for the class average to be 70% or higher on the assessment. | **Percent of Program Achieving Target** | The class average was 87.52%. (n=26) |
| **Methods**  | All sections of GISC 317 during AY23 were included in the data set. A comprehensive rubric was used to evaluate each of the five projects. All project scores were averaged to create the program average. For n=26 students, the program average was 87.52% |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| As the success target for this measurement was met, no follow-up actions are required. Annually, we update all modules in our GISC courses to incorporate any added capabilities of the latest geoscience spatial analysis software and adapt to any changes in GISC technologies and software. Project, assignment, and exam data utilized in our GISC courses are updated to reflect the latest challenges and opportunities present in the geosciences.It is believed that the average score increased significantly as the students that did not perform as well in the beginning of the semester withdrew from the course without completing all five projects. This could account for the higher average as the more successful students remained in the course. Since this outcome was achieved, we have no intended changes to our program to meet this outcome at this time. We are constantly improving and updating our curriculum, equipment, lab and field research methods and tools, to meet our students’ needs. If deficiencies in any area arise, we are nimble and effective in our responses to our programmatic needs.GISC 317 is taught every spring and will be remodeled for the spring 2024 semster.  |

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| **Program Student Learning Outcome 3** |
| **Program Student Learning Outcome**  | Students will demonstrate proficiency in GIS project planning, design, and implementation, as well as mastery of advanced geoprocessing and modeling techniques. |
| **Measurement Instrument 1** | Direct measures of student learning (GISC 417): Students in the capstone course, GISC 417 (GIS Analysis & Modeling), were given a final group project for demonstrating skills and knowledge in data visualization and cartography from the core courses, GISC 316 and GISC 317, as well as skills and knowledge from GISC 417. All three courses are required courses in the GIS Certificate program. In addition, students presented their project findings orally. |
| **Criteria for Student Success** | The overall score on the capstone project will be 70% or higher in GISC 417. |
| **Program Success Target for this Measurement** | The goal is for the class project average to be 70% or higher on the assessment. | **Percent of Program Achieving Target** | GISC 417: The class average was 88.2%. (n=17) |
| **Methods**  | In GISC 417, all students’ group papers, project data, and maps from GISC 417 in AY23 (Fall 2022) were evaluated. A comprehensive rubric was used to evaluate students’ planning, design, and project implementation. The total project score of all students was averaged. For n=17 students, the average capstone project score was 88.2%. |
| **Measurement Instrument 2** | Direct measures of student learning (GISC 419): Students in this advanced GIS course, GISC 419 (GIS Programming) completed independently 6 applied projects to implement custom GIS analytical tools with ArcGIS ModelBuilder and Python scripting. |
| **Criteria for Student Success** | The average scores on the six project will be 70% or higher in GISC 419. |
| **Program Success Target for this Measurement** | The goal is for the class project average to be 70% or higher on the assessment. | **Percent of Program Achieving Target** | GISC 419: The class average was 92.3%. (n=13) |
| **Methods** | In GISC 419, all six applied GIS projects in AY23 (Spring 2023) were evaluated. A comprehensive rubric was used for all six projects. The total project score of all students was averaged. For n=13 students, the average capstone project score was 92.3%. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| The goals for this SLO were met, so no follow-up action is required for both GISC 417 and 419. We have seen a slight increase in the overall percent of student’s passing the GISC 417 final project with a C or higher from 86.2% to 88.2%. The overall percent of student’s passing the GISC 419 projects with a C or higher is about the same compared to the past AY.As these courses are taught annually, we will continue to assess this outcome in the next academic year. It is vital that we analyze the same statistics, for the next academic year, to better understand if the pandemic contributed to these changes. |

**GISC 316 Capstone Project Rubric**

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| **Project and File Management*** A complete project has been delivered, including all data and project files, with no broken links, and a written report. No extraneous data is included.
 |  / 5 points |
| **Vector Data Management*** A custom projection for the study area has been created and appropriately named, and the project uses the custom projection.
* Data has been organized logically in a geodatabase using feature classes and feature data sets, and all data has been converted to the custom projection.
* The metadata for each feature class has been updated with information on subsetting, clipping and re-projection and new thumbnail images have been created for any altered feature classes.
 | / 10 points |
| **Map Symbology & Labeling** * A graduated color map using correct normalization and an appropriate quantitative classification has been created.
* Principles of good cartographic design have been followed in selection of colors and placement of labels.
 |  / 15 points |
| **Map Layout*** The map layout communicates effectively by using principles of cartographic design to place and orient map elements, including a map title, legend, scale bar, and any inset or locator maps used.
* The map uses principles of visual hierarchy to emphasize important information.
 | / 10 points |
| **Report** * The report is well written from a technical standpoint (e.g. grammar and spelling) and makes a cogent analysis of information presented on the map.
 | / 10 points |
| **Total:** |  **/ 50 points** |

GISC 317 Rubric Example

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| Georeferencing – Criteria:* The image is accurately georeferenced to the orthophotos
* The images were given correct spatial metadata
* Include RMS score or table image in write-up
 |  /10pts  |
| Feature accuracy - Attribute accuracy – Criteria: * A polygon feature class was created to hold the polygons multiple were created instead of just one as indicated in the directions.
* All data sets reside in the geodatabase
* the feature class’s spatial reference was correctly defined
* all polygons are present
* no extra polygons, gaps, slivers of open areas
* Domain Created. Students should follow the same set up as learned in the digitizing practice assignment. A suitable attribute domain for soil type was created in the geodatabase. The geodatabase and subsidiary structures have been set up correctly with a domain
* Attribute were created and it reference the attribute domain
* All polygons have been given a correct attribute value
 |  /30pts  |
| Digitizing quality – Criteria:* lines are smooth
* lines accurately placed relative to areas on photo at edges
* adjacent polygons form a smooth boundary
 |  /20pts  |
| Symbology – Criteria:* Each lot type has been given a different color and an appropriate color scheme was selected
* Labels do not overlap polygon lines and are well place
 |  /20pts  |
| Metadata – Criteria:* Created the required metadata for the polygon feature class
* The metadata contains good and reasonable information
 |  /10pts  |
| Project management – Other Criteria: * all files are present
* no broken links in the map project
* all names are well chosen and descriptive
* All extraneous files (other than the geodatabase, map, & pdf) have been removed
* Named layers in the Table of contents (instead of a legend)
* Completion is of professional quality.
 |  /10pts  |
| Total: |  /100pts  |

GISC 417 Capstone Project Rubric Example

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| Project planning & design – Criteria:* Study area determined
* Facility type determined
* A project proposal with project objectives and steps
 |  /10pts  |
| Project data collection – Criteria: * Sidewalk centerlines collected in the study area with GPS and Collector for ArcGIS
* Other required GIS datasets collected in the study area, e.g. facilities, crosswalks, junctions, steps
* Project data made available on ArcGIS Online as basic web maps
* All project data sets converted in a project geodatabase
 |  /20pts  |
| Project data processing – Criteria:* Sidewalk centerlines planarized
* A network dataset built with sidewalk centerlines and walk time cost attribute
 |  /20pts  |
| Network analysis – Criteria:* A service area analysis conducted to general walk time network polygons with proper walk time breaks
 |  /20pts  |
| Project map – Criteria:* A final ArcGIS Online map created
 |  /10pts  |
| Project report – Criteria: * In APA style: page numbers, title page, font and font size, line spacing, justification, and margins
* Figures and tables titled and numbered
* Project sections: Introduction, Data and Methods, Results, Conclusions
* Maps must follow standard principles of cartographic design: layout, legend, map title, scale, etc.
 |  /20pts  |
| Total: |  /100pts  |

GISC 419 Project Rubric Example

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| Data/file management – Criteria:* Practice good data/file management: subfolders, file/data names
* Submission files in a single zipped folder file
 |  /10pts  |
| Tool development – Criteria: * Target geoprocessing workflow identified and tested manually
* Custom tool developed with proper tool parameters and properties.
* Custom tool tested and debugged without any errors
 |  /60pts  |
| Tool documentation and metadata – Criteria:* Basic naming conventions followed in ArcGIS models or Python scripts
* Proper labels added in ArcGIS models
* Proper comments added in Python scripts
* Tool metadata created
 |  /20pts  |
| Project short report – Criteria: * In APA style: page numbers, title, font and font size, line spacing, justification, and margins
* Figures and tables titled and numbered
* Report presented in sections
* Main lessons learned reported in the conclusion section
 |  /10pts  |
| Total: |  /100pts  |

**Curriculum Map – GISC Certificate**

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| **Program name:** | Certificate in GIS |
| **Department:** | EEAS |
| **College:** | Ogden |
| **Contact person:** | Amy Nemon |
| **Email:** | amy.nemon@wku.edi |

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| KEY: |
| I = Introduced |
| R = Reinforced/Developed |
| M = Mastered |
| A = Assessed |

LO1: Students will be able to organize GIS data and communicate effectively through mapping using accepted principles of cartographic design and spatial reference systems.

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| GISC  | 316 | Fundamentals of GIS | I, R, M, A |
| GISC  | 317 | Geographic Informations Systems | M, A |
| GISC  | 417 | GIS Analysis & Modeling | M, |
| GISC  | 419 | GIS Programming | M |

LO2: Students can demonstrate proficiency in the quantitative and qualitative spatial analysis and critical thinking through written and oral communication.

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| **Course Subject** | **Number** | **Course Title** |   |
| GISC  | 316 | Fundamentals of GIS | I |
| GISC  | 317 | Geographic Informations Systems | R, M, A |
| GISC  | 417 | GIS Analysis & Modeling | M |
| GISC  | 419 | GIS Programming | M |

LO3: Students will demonstrate proficiency in GIS project planning, design, and implementation, as well as mastery of advanced geoprocessing and modeling techniques.

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| **Course Subject** | **Number** | **Course Title** |   |
| GISC  | 316 | Fundamentals of GIS | I |
| GISC  | 317 | Geographic Informations Systems | R |
| GISC  | 417 | GIS Analysis & Modeling | M, A |
| GISC  | 419 | GIS Programming | M, A |