

STUDENT LEARNING ASSESSMENT PROGRAM SUMMARY FORM *AY2020-2021*

Program Name: Professional Science Masters in Geographic Information Science (PSM in GIScience)

Dept: Geology/Geography

College: CLAS

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Part 1:

The learning objectives for the PSM in GIScience program are listed on the following pages and are classified by CGS learning goal. Objectives are assessed in the classroom, as well as in reports, presentations, and professional settings as possible. Data collection methods include the following assessments:

1. Classroom Evaluations

When possible, learning goals are assessed through the evaluation of select student classroom work. For instance, when students complete a research paper, their work is assessed and reported via the standard Geography Paper Assessment Evaluation instrument (See Appendix A). Likewise, if students are required to perform a class presentation, their work is assessed on the Geography Speech Assessment instrument (See Appendix B). Most other classroom evaluation is assessed based on *embedded content questions* in essay exams. This allows students to demonstrate a broader understanding of geospatial fundamentals. For standardization purposes, all classroom work is assessed on a likert scale. Evaluation options range from 1 (No discernible ability), to 2 (Minimal ability), to 3 (Satisfactory ability), to 4 (Significant ability), and finally 5 (Superior ability). As this quantization of results is just being phased in on essay tests among faculty this year, we have set the initial goal of having the mean student achievement rank between 4 and 5 (Significant to Superior).

2. Final GIS (Internship) Written Report

Students are required to submit a written report of a GIS research or professional project in order to fulfill the Certificate of Comprehensive Knowledge requirement for the graduate school. In practice this report tends to be linked to the student's required internship activities (though the option to complete supervised research exists as well). This is typically completed just prior to graduation and is often the last requirement met by the student. This report should be comprehensive and succinct, demonstrating professionalism. Any research or methods mentioned should be appropriately cited and sourced. Project reports are currently evaluated by the Graduate Coordinator as well as one other faculty member. Work is evaluated as soon as the report is submitted with the opportunity for feedback and revision.

3. Final GIS (Internship) Project Presentation

In conjunction with the written report, GIScience PSM students are required to complete an oral presentation on the same internship or research project. Students are expected to clearly communicate the purpose, context, and background of their work. Their presentations should be professional and comprehensive, explaining purpose, process, challenges, achievements, analysis, limitations of their work, and future directions or needs. Project presentations are evaluated by all attending faculty (at least two GIScience graduate faculty must be in attendance) and feedback is provided to students.

4. Alumni Surveys

Once every 4-5 years a summary of graduate alumni is conducted to evaluate student perception of their experience in the program, current employment, and relevance of program curriculum to their career. The interval relates to the (to date) small pools of graduates from the PSM in GIScience and need for an appropriate sample size. The last survey was conducted in 2018, and we are preparing a new instrument to send out in Spring 2022. The survey will be composed of approximately 20 questions and utilize both objective (likert) and subjective (open-ended) formats.

In the 2020-21 academic year the PSM in GIScience had *seven students* graduate.

<p>CGS Learning Goal #1 A depth of content knowledge</p>	<p>Program Learning Goal(s): #1a Manage data workflow (create, edit, convert, filter, document) in various GIS formats (vector and raster)</p>
<p>How are learners assessed?</p>	<p>Final project report on internship experience (CCK) as well as classroom assessment questions. Results are collected by individual professors and compiled on a semester basis, while attending professors evaluate student internship final projects.</p>
<p>What are the expectations for the students?</p>	<p>Students will provide evidence of identifying and acquiring multiple relevant data sources, perform appropriate editing, conversion and filter tasks, and properly document and justify their data processing steps.</p>
<p>What are the expectations for the program?</p>	<p>Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)</p>
<p>What were the results?</p>	<p>Classroom assessments in two classes yielded means of 4 and 4.5 or a weighted mean of 4.28. This would represent a <i>significant</i> level of understanding for this skill.</p>

	Assessment of graduates by professors in attendance at their defense produced a mean of 4.6 or <i>significant leaning towards superior</i> rating in this category.
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a graduate faculty meeting on a semester-by-semester basis.

CGS Learning Goal #1 A depth of content knowledge	Program Learning Goal(s): #1b Construct and visualize data products (maps, interactive databases) to effectively communicate information
How are learners assessed?	Results are solicited from attending professors at final project presentations (CCK).
What are the expectations for the students?	Students will use thematic maps and interactive visualization tools to effectively communicate results and analysis. Graphic representation should be self-explanatory, with a clear message and appropriate symbolization.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Assessment of student abilities to create visualization products to communicate their final project work was assessed by attending professors. This group rated student abilities in this category at 4.25 or <i>significant</i> .
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a graduate faculty meeting on a semester-by-semester basis.

CGS Learning Goal #1 A depth of content knowledge	Program Learning Goal(s): #1c Design frameworks and procedures to support GIS data collection, management and analysis.
How are learners assessed?	Results are solicited from attending professors at final project presentations (CCK).
What are the expectations for the students?	Students will demonstrate the ability to construct relational geodatabases, procedural geoprocessing models, and/or python scripts to accomplish specific data compilation goals, processing procedures and analysis.

What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Professors assessing student final internship or research projects assessed ability to design appropriate data flow models and methodology as 4.5, or somewhere between significant and superior .
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a graduate faculty meeting on a semester-by-semester basis.

CGS Learning Goal #2: Critical thinking and problem-solving skills	Program Learning Goal(s): #2a Derive higher-order spatial information from base (raw survey, GPS, satellite/aerial, or other sensor) data sources
How are learners assessed?	Final project report on internship experience (CCK) as well as classroom assessment questions. Results are collected by individual professors and compiled on a semester basis, while attending professors evaluate student internship final projects.
What are the expectations for the students?	Students will clearly define the scope and objectives of their project, including spatial data requirements and appropriate analysis techniques.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Two classroom assessments of the ability to produce value-added products from raw spatial data yielded means of 3.7 and 4.5, or a weighted mean of 4.14. This would represent a significant ability in this category. Assessments of graduating seniors for this category produced a mean average of 4, again representing a significant ability for this skill.
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a yearly graduate faculty meeting.

CGS Learning Goal #2:	Program Learning Goal(s): #2b
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Critical thinking and problem-solving skills	Place project within correct organizational context and justify expense (both temporal and monetary).
How are learners assessed?	Results are solicited from attending professors at final internship project presentations (CCK).
What are the expectations for the students?	Students will be able to explain how their internship project benefits and supports the cooperating organization and discuss any limitations in terms of data quality, time, and available resources.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Assessment of graduating students at their final project presentations by professors in attendance indicated a mean of 4.75 in this category representing a <i>superior</i> ability at justification and contextualization of their work.
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a graduate faculty meeting yearly.

CGS Learning Goal #3: Effective oral and written communication skills	Program Learning Goal(s): #3a Communicate all aspects of GIS work from process to analysis in a clear, concise written form.
How are learners assessed?	Professors requiring research projects assess students based on the Geography Paper Assessment Evaluation instrument (See Appendix A). Additionally, supervising professors evaluate student final project written reports.
What are the expectations for the students?	Students will present well-organized, clearly-written reports of process as well as coherent justification and analysis in their work.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Written communication was assessed in three classes throughout the year where term papers were expected. The mean for the courses were 4.5, 4, and 4 respectively. The weighted mean for all written assessments across classes was 4.18 indicating a <i>significant</i> level of written communication skill for assessed students.

	Likewise, eight student final internship or research projects were assessed. The mean skill was assessed at 4.13 or significant by supervising faculty.
How are the results shared? How will these results be used?	Student status and overall written communication ability will be reviewed in a graduate faculty meeting on a semester-by-semester basis.

CGS Learning Goal #3: Effective oral and written communication skills	Program Learning Goal(s): #3b Present and verbally relate work and analysis in an organized, professional, and coherent manner.
How are learners assessed?	Professors requiring research projects assess students based on the Geography Speech Assessment instrument (See Appendix B). Additionally, supervising professors evaluate student final project oral reports.
What are the expectations for the students?	Students will effectively and professionally deliver an interactive oral presentation explaining project justification, process and analysis.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Oral communication and presentation skills were assessed in three classes during the assessment period. The means for these three classes were 4.5, 4.3 and 4.0 respectively. The overall weighted mean of assessed presentations was 4.3, indicating a significant communication ability amongst students. Presentation and communication skills were also evaluated in final internship or research presentations for the eight graduating students. The overall speaking and communication ability of PSM graduates was assessed as 4.4 or significant .
How are the results shared? How will these results be used?	Student status and overall verbal communication ability will be reviewed in a graduate faculty meeting on a semester-by-semester basis.

CGS Learning Goal #4: Evidence of advanced scholarship through research and/or creative activity.	Program Learning Goal(s): #4 Appropriately utilize high-quality research sources and methods in the application and analysis of geospatial problems.
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How are learners assessed?	Professors requiring research projects and/or project design (for instance a programming course) evaluate student performance. Additionally, student internship/research reports are evaluated for research and methodological support by supervising professors.
What are the expectations for the students?	Students should be able to identify and obtain high-quality theoretical and procedural literature to support their methods. Analytical methods should show robust support and a strong theoretical underpinning.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Learning goal 4b was assessed in three classes during the term in question. Student means for these courses were 3.75, 3.3, and 3.25 for a weighted mean of 3.5. This indicates a point somewhere between satisfactory and significant for this skill. Graduating students were also assessed in their final projects on this skill. Supervising professors rated this skill a 3.75, indicating a significant ability to appropriately analyze geospatial problems.
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a graduate faculty meeting yearly.

CGS Learning Goal #5: Ethics and Professional Responsibility	Program Learning Goal(s): #5a Identify and discuss emerging trends in GIS-related technology, regulations, standards and norms and their impacts on society.
How are learners assessed?	Results are collected by individual professors and compiled on a semester basis (as appropriate PSM seminar or other topical seminars are offered). Additionally, attending professors evaluate student internship final projects (CCK).
What are the expectations for the students?	Students will demonstrate an understanding of emerging web technologies, open source software and volunteered geographic information and be able to discuss the need for spatial data infrastructure as well as controversies regarding data privacy.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	Students were assessed on their understanding of the state of technology, the importance of open standards, and how these matters impact society in three classes.

	<p>Individual classes were rated a 4.6, a 4.5, and a 5. The weighted mean for these classes was a 4.7 indicating a <i>superior</i> level of achievement in this goal.</p> <p>Graduating students were also evaluated on this goal in their final project presentations. Professors assessed these students as have a 4.0 or <i>significant</i> level of achievement in understanding the state of the profession today.</p>
How are the results shared? How will these results be used?	Student status and overall content mastery will be reviewed in a graduate faculty meeting yearly.

CGS Learning Goal #5: Ethics and Professional Responsibility	Program Learning Goal(s): #5b Identify and model ethical behavior in the professional realm
How are learners assessed?	Students are assessed in the PSM seminar course (where these matters are discussed explicitly) as well as in their internship (final project) report.
What are the expectations for the students?	Students will interact with others in a professional manner while adhering to ethical standards of data stewardship, objective analysis, and transparent research practices.
What are the expectations for the program?	Average student achievement should rank in the significant to superior range (4-5 on a 5 point likert scale)
What were the results?	<p>PSM seminar students in the Fall of 2020 were assessed for their ability to identify ethical behavior and data-handling standards, and their ability to present themselves professionally. Overall, professors ranked these students at a 3.5 or <i>satisfactory</i> standard of professionalism. It should be noted that with only 4 students, this was an exceptionally small sample.</p> <p>Students completing their final project in the GIScience PSM were also assessed for ethical understanding and professionalism (with added input from their external supervisors). These students were rated a 4.25 overall or <i>significant</i> ability to model ethical and professional behavior.</p>
How are the results shared? How will these results be used?	Student status and overall ethical performance will be reviewed in a graduate faculty meeting yearly.

Part 2

Describe what your program's assessment accomplishments since your last report was submitted. Discuss ways in which you have responded to the Graduate Assessment Summary Response from last year's report or simply describe what assessment work was initiated, continued, or completed.

The PSM in GIScience program has undertaken a number of changes since last year's assessment. First and foremost, we have overhauled all of our program learning goals while increasing the number of items assessed to better align with the CGS learning goals, as suggested in last year's response. We have endeavored to include a mixture of both summative and formative evaluation measures to provide feedback throughout the graduate learning process. While we continue to include many assessments based on the student's final internship or research project, the number of in-course assessments based on essay test questions or term projects has been increased to provide the opportunity for student assessment and intervention earlier in the program.

We have experienced greater buy-in within the assessment program, with more faculty participation representing more individual classes than previous rounds. Broadening the number of course offerings being evaluated has provided a much more complete picture of the program in terms of both strengths and weaknesses. By scheduling meetings to review assessment materials on a more frequent basis (yearly or each semester when possible) the timeliness and ability to intercede if individual students or cohorts show challenges has increased.

With the addition of a greater amount of numerical data being collected, we are working to establish better expectations of student achievement. For the first year of wide-scale numerical collection in all classes, we have set a goal to have the mean student score in the 4-5 range on a likert scale (representing a significant to superior grasp of each concept). Moving forward, we would like to set benchmarks for percentages of students achieving a certain score. This has been difficult to date due to the small number of students in the classes and the program overall. For instance, with only eight graduating students to assess in some categories, one or two students can have an outsize impact on percentage calculations.

Beyond classroom and presentation assessment, we are currently working to refine our alumni survey in anticipation of administering it once again in Spring 2022. We are particularly looking to gain feedback on useful skills and any potential learning gaps in our program that may be addressed. In a similar vein, we are looking to reinstitute yearly meetings of the GIScience external advisory board. Though we have been unable to convene this group for two years due to covid-related issues, we are currently engaged in soliciting new members to replace board members lost to attrition. Industry and government stakeholders provide professional feedback on needed skills and useful curricular updates.

Part 3

Summarize changes and improvements in curriculum, instruction, and learning that have resulted from the implementation of your assessment program. How have you used the data? What have you learned? In light of what you have learned through your assessment efforts this year and in past years, what are your plans for the future?

A number of direct curricular changes have come about as a result of recent assessment activities. As of 2020, the new GEO5000 Geographic Information Science Seminar was added to core content. This one-hour class presents program expectations, introduces students to research expectations, provides the opportunity for outside experts to share their experiences with students, and builds bonds within each cohort. Feedback garnered from assessment made clear the need for a foundational course to establish expectations and standards. A second major change has been the removal of GEO5810 Introduction to GIS from the core and its replacement by a new class: GEO4810 Cartography and Geographic Data Visualization. Ongoing assessment highlighted a need for better visualization and mapmaking skills among PSM students. In concert, it was recognized that introductory GIS was redundant for the vast majority of program admits (who usually joined the program with extensive undergraduate or professional experience). The cartography and data visualization class refines in-demand industry skillsets while increasing student analytical expertise.

The latest year's data has also highlighted both strengths and weaknesses in our program we are moving to address. While eight out of ten of the programmatic goals assessed performed at our level of expectation (the 4-5 or significant to superior category), the two goals which failed to reach this standard came as a bit of a surprise. Specifically, underperformance in the second ethics and professionalism goal (demonstrating these skills in the classroom and beyond), was a disappointment. Likewise, lower-than-expected performance in goal #4 (appropriate use of high quality, well-documented sources and methods) has brought to our attention a weakness among the latest cohorts of students. Both of these issues are being addressed currently in the Fall 2021 GEO5000 seminar. More time has been dedicated to developing literature reviews and critiquing journal articles. We are also endeavoring to stress the need for professionalism in all interactions, with professors, colleagues, or employers. On the positive side, it was gratifying to see strong performance on content knowledge assessment as well as critical thinking and problem-solving skills.

Moving forward, we plan to create more opportunities for students to develop research and professional skills. We are considering recruiting our library content representative to hold a workshop on sharpening research skills. We are looking to encourage greater commitment to professional behavior by establishing more opportunities for students to interact with professionals outside the classroom setting. Finally, we are working to build expectations of behavior and norms through encouraging greater interaction of our graduate students with campus-wide as well as disciplinary organizations (while also enhancing cohort bonds).

As the year continues, GIScience professors are working to meet on a more frequent basis to review assessment data (more than once a year) and share information about strengths and weaknesses in the program. The new program goals would likely benefit from further refinement and clarification to help those performing assessment clearly differentiate categories. We will continue to reach out to “infrequent” faculty who might teach on an adjunct basis from time to time to encourage their participation in assessment as well. And with our program’s move to fully online status, and a shift in students towards an older and more domestic audience, we will keep a close watch on goals to identify emerging needs within this new demographic.

Appendix A

Geography Program Paper Assessment Evaluation

Student:
Topic:

Semester:
Course:

Length/Formatting:

Length and formatting (font/margins) appropriate

5 4 3 2 1 0

Organization:

Ideas clearly organized, use of intro/conclusion, material flows

5 4 3 2 1 0

Critical Thinking:

Proper support of arguments, analysis of concepts and theory

5 4 3 2 1 0

Information Presented:

Facts understandable, accurate, and assignment relates to class/geography

5 4 3 2 1 0

Language (Style and Grammar):

Appropriate tense, proper language, relevant punctuation

5 4 3 2 1 0

Graphics:

Effective use of graphical materials, maps, charts and other visual devices

5 4 3 2 1 0

Citations:

Proper use of reference, parenthetical citation or footnotes, etc.

5 4 3 2 1 0

Overall Grade:

5 4 3 2 1 0

Comments:

- 5** *The student demonstrates a superior ability in written communication*
- 4** *The student demonstrates a significant ability in written communication*
- 3** *The student demonstrates a satisfactory ability in written communication*
- 2** *The student demonstrates a less than satisfactory in written communication*
- 1** *The student demonstrates no discernible ability in written communication*

Appendix B

Geography Program Speech Assessment Evaluation

Presenter:
Topic:

Semester:
Course:

Time of Presentation:

Time requirements met by the student.

5 4 3 2 1 0

Presentation Organization:

Ideas clearly organized, presenter prepared, flow of presentation

5 4 3 2 1 0

Information Presented:

Understandable, accurate, assignment relates to class/geography

5 4 3 2 1 0

Presentation Style:

Language used, articulate, eye contact, use of notes, pitch, free of fillers, professionalism

5 4 3 2 1 0

Graphics:

Use of visual aids ex: (maps, graphs, pictures, charts)

5 4 3 2 1 0

Overall Grade:

5 4 3 2 1 0

- 5** *The student demonstrates a superior ability to communicate research ideas*
- 4** *The student demonstrates a significant ability to communicate research ideas*
- 3** *The student demonstrates a satisfactory ability to communicate research ideas*
- 2** *The student demonstrates a less than satisfactory ability to communicate research*
- 1** *The student demonstrates no discernible ability to communicate research*