STUDENT LEARNING ASSESSMENT PROGRAM SUMMARY FORM *AY2021-2022*

Program Name: Name: Professional Science Masters in Geographic Information Science (PSM in GIScience)
Dept: Geology/Geography
College: CLAS
Submitted by: David Viertel

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 for this cycle included 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 and ethical responsibility. Any research or methods mentioned must 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 with the opportunity to address suggested changes in their written work (see above).

In the 2021-22 academic year the PSM in GIScience had **two students** graduate.

CGS Learning Goal #1 A depth of content knowledge	Program Learning Goal(s): #1a **Manage data workflow (create, edit, convert, filter, document) in various GIS formats (vector and raster)**
How are learners assessed?	Final project report on internship experience (CCK) as well as classroom assessment questions. Classroom 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 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.
What are the expectations for the program?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)
What were the results?	Classroom assessments in one class yielded a mean of 4.28. This would represent a *significant* level of understanding for this skill. Assessment of graduates by professors in attendance at their defense produced a mean of 4.75 or *significant leaning towards superior* 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. Results are used to update and focus course curriculum and redesign Intro to GIS (GEO5810) and Remote Sensing I (GEO5820) courses.

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?	Avg. student achievement will rank significant to superior (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 4.5 or *significant*.
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. Earlier results have led to the development of a graduate Cartography and Visualization course (beginning in Fall 2021). The students required to take this course should be graduating beginning Spring 2023.

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?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)
What were the results?	Professors assessing student final internship or research projects assessed ability to design data models as 4.75, or a *significant leaning towards superior* rating.
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. Again, feedback from earlier results has led to changes in the GEO5810 and GEO5820 foundational classes.

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?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)
What were the results?	One classroom assessment of the ability to produce value-added products from raw spatial data yielded a mean 4.5. This would represent a *significant* ability in this category. Assessments of graduating seniors for this category produced a mean average of 4.5, 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. Past consultation has led to revised content in the required GEO5000 PSM Seminar course which focuses on appropriate uses and evaluation of data.

CGS Learning Goal #2: Critical thinking and problem-solving skills	Program Learning Goal(s): #2b **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 project presentations (CCK).
What are the expectations for the students?	Students will be able to explain how their internship or research project benefits and supports the cooperating organization and discuss limitations in terms of data quality, time, and available resources.
What are the expectations for the program?	Avg. student achievement will rank significant to superior (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 5 in this category representing a *superior* 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. The professional course component of the PSM seems to be achieving this goal.

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?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)
What were the results?	Written communication was assessed in two classes throughout the year where term papers were expected. The mean for the courses were 3.75 and 4.22 respectively. The weighted mean for all written assessments across classes was 4.07 indicating a *significant* level of written communication skill for assessed students. Likewise, two student final internship or research projects were assessed. The mean skill was assessed at 4.25 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. An effort to include more written work in classes, including summaries of peer-reviewed literature is ongoing.

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?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)

What were the results?	Oral communication and presentation skills were assessed in two classes during the assessment period. The means for these two classes were 4.22 and 4.5 respectively. The overall weighted mean of assessed presentations was 4.27, 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 4.5 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. More opportunities for student-led talks have been added to certain classes, allowing more active practice.

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.**
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?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)
What were the results?	Learning goal 4b was assessed in two classes during the term in question. Student means for these courses were 3.75 and 4.11 for a weighted mean of 3.99. This indicates a point somewhere past **satisfactory and leaning towards significant** for this skill. Graduating students were also assessed in their final projects on this skill. Supervising professors rated this skill a 4.5, 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. An emphasis on assessing sources has been added to GEO5000 (PSM Seminar).

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?	Avg. student achievement will rank significant to superior (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 two classes. Individual classes were rated a 3.75 and a 4.5. The weighted mean for these classes was a 4.0 indicating a *significant* level of achievement in this goal. Graduating students were also evaluated on this goal in their final project presentations. Professors assessed these students as having a 4.75 or *significant leaning towards superior* level of achievement in understanding the state of the profession today.
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. This feedback will be used to sharpen the subject matter of both the GEO5000 Seminar and Topics in GIS courses going forward.

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 or research (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?	Avg. student achievement will rank significant to superior (4-5 on a 5 point likert scale)
What were the results?	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 4.5 or *significant* standard of professionalism. 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 4.75 overall or *significant leaning towards superior* ability to model ethical and professional behavior.
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. Greater stress has been placed on the ethics and impacts of data use both in the PSM Seminar course as well as in supervision of individual projects and internships.

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 continues to refine our assessment process as our program experiences major changes. The new list of assessment procedures added last year works to deliver greater clarity into the strong and weak spots within our curriculum. A challenge continues to be the low numbers of students being assessed, though enrollment numbers are up this Fall, promising a larger group to assess in the future.

More metrics are being assessed for individual classes since last year, including a "professionalism and ethics" score being keyed to group work and/or the degree of professional behavior demonstrated in class interactions. This has provided insight into student preparedness for both group meetings and one-on-one interactions in the professional world. Additionally, the fact that several offerings last year appealed to a wider audience than just PSM students helped professors calibrate these characteristics between in-department (PSM) and out-of-department students. This allowed for a larger sample size to set appropriate expectations.

Several recent contacts with alumni have also allowed the evaluation of how students are faring two to three years post-graduation. One student has been hired on as the GIS manager for the San Jose International Airport. A second student is moving from an agricultural engineering and analysis firm to a management job with a national civil engineering firm. A third student, currently teaching at King Fahd University in Saudi Arabia, is seeking entrance into a PhD program to advance his higher-education career. Though anecdotal, the success of these recent graduates and their ability to advance their career goals is heartening.

As mentioned, the biggest weakness in our numerical data is simply a small sample size. For instance, with only two individual graduates over the past year (due to low enrollment during covid), the assessments obtained from the Certificate of Comprehensive Knowledge evaluations were heavily individual-dependent. It might be worthwhile to consider an exit-survey where the students have the ability to voice their perceptions of how the program addressed and responded to their individual needs. More consideration of such a vehicle is in order.

Finally, it will be important to assess other aspects of our program moving forward, in addition to the conventional graduate school goals. For instance, with our new population of online (and mostly fully-employed) PSM students we must be particularly sensitive to format and timing issues. While we expected to draw students from across Illinois, several West Coast students have joined the

program, creating time-zone-related issues that weren't anticipated. It will be important to be responsive and supportive of their needs.

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?

While in the last several years, assessment results led to major curricular adjustments and changes, this year faculty have chosen to focus on modifying and updating course content to better meet the needs of students. For instance, weaknesses in both writing and speech measures were spotted last year, leading to a greater emphasis being placed on these components within several PSM courses. Adding in opportunities to reflect upon and measure professionalism has also been a priority. The Land Use Planning course offered in Spring 2022 was modified to include a participatory planning exercise where graduate students took the lead to organize groups of undergraduate students (it was a mixed class). By allowing grad students to assume authority and provide direction they had an opportunity to show their skills at management and organization. The GEO5810 Intro to GIS course was also modified to better expose students to the importance of data design frameworks.

As another effort to enhance the ability of students to engage in professional activities, several colloquia were held with professionals in the field. Participants included alumni playing an important leadership role with their current organizations. This not only allowed students to interact with leaders in the GIS field, but also provided networking opportunities and the possibility of establishing an internship relationship with these agencies. These invited speakers were part of both the wider departmental context, as well as several who addressed the PSM seminar class, providing a more personal forum. Response to these activities were excellent and we hope to continue to use outside visitors (in-person or virtual) to benefit student professional development.

With healthy enrollment growth in Fall 2022, the PSM in GIScience is focused on building on current success and leveraging this community to continue to expand our student population. Alumni outreach has proven a particularly good way to reach potential students. Yet as the scope of students expands, we are also keenly aware that their needs are growing more diverse. Assessment, in the form of continual feedback from classes, current students and alumni will play an important role in making further progress towards recruitment goals.

Appendix A

Geography Program Paper Assessment Evaluation

Student: **Semester:**
Topic: **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: **Semester:**
Topic: **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*