Collaborative Development and Assessment of Student Learning Outcomes for LIS Electives

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In higher education's environment of accountability, the development and assessment of student learning outcomes (SLOs) are driven by both external stakeholder requirements for accreditation and internal institutional pressures to demonstrate student learning as the core function of universities and colleges. This paper presents a framework to reduce faculty workload and increase standardization of SLOs for LIS electives across multiple schools. The framework includes a value-added assessment with results that show a significant increase in the overall scores and specifically in areas of focus for the elective. This approach provides a framework for other popular LIS electives to collaborate across schools and standardize SLOs to determine the overall effectiveness of courses and programs without reinventing course objectives, SLOs, and evaluation techniques at each institution.

Keywords: student learning outcomes; value-added assessment; educational effectiveness; geographic information systems; geographic information

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The creation and assessment of student learning outcomes is an essential part of higher education, with an increasing focus on evaluating educational effectiveness especially in North America. While colleges and universities have integrated assessment into their everyday practices, the topic continues to evolve. In particular, learning outcomes at the student and program levels are now the primary way of measuring student success, as well as the effectiveness of individual courses, instructors, programs, colleges, and institutions. Though assessment may look different at each level, ranging from student, to course, to program, the assessment process is recognized as playing a crucial role in the totality of student learning (Praslova, 2010).

Assessment has been defined in a number of ways as applied to various contexts and purposes. In the past, whereas assessment often referred solely to assigning grades in the classroom, it now occurs at multiple levels. Data collected helps refine student learning through course revision, program change, and teaching approaches. Assessment provides valuable feedback regarding the effectiveness of specific courses and programs, allowing educators to see the link between their courses and what students are (or are not) learning (Hock & Mellard, 2011). Thus assessment is more than determining if students learn

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what educators intend for them to learn, but assessment also involves improving both future instruction and student learning.

In an era of increasing accountability within higher education, the development of measurable student learning outcomes (SLOs) and carrying out meaningful assessment of those SLOs is at the core of student learning (McNeill, Gosper, & Xu, 2012). Although there are pragmatic reasons such as external stakeholder requirements that increase the importance of SLOs, there are also growing internal institutional pressures. North American universities and colleges are realizing "the centrality of student learning to fulfilling their mission and to meeting . . . expectations that investments in higher education do in fact result in students acquiring knowledge, skills, attitudes, and behaviors aligned with course and program objectives" (Bers, 2008, p. 38–39). Assessment ultimately drives the development of pedagogy (teaching methods, instructional theories, and learning objectives), which in turn provides stakeholders with evidence of a course or program's success. This paper focuses on assessment of SLOs derived from a survey validation study for a new elective in library and information science. It also provides detail of the approach used, findings, and discussion of implications for other course assessments for LIS education in North America.

Literature Review

Within recent years, a growing body of literature has emerged that recognizes the crucial role assessment plays in supporting student learning (McNeill *et al.*, 2012). However, much of the higher education literature concerning assessment approaches it from a theoretical standpoint, with significantly fewer publications that present "actual assessment results or detail how these results were used by a department or institution" (Bers, 2008, p.31). Nevertheless, recent works provide insight that shapes how educators understand the purpose and practice of carrying out assessments and aid in building effective assessments and measurable, evidence-based SLOs (Crisp, 2012).

While assessments can be formal or informal, direct or indirect, and carried out through a variety of methods, all assessments should be informed by standards or goals that are articulated in SLOs that are either developed by faculty members or institutions as a whole (Ewell, 2006; Walvoord & Banta, 2010). Though some sort of assessment always occurs within education, in the 1990s the rhetoric and practice surrounding it began to evolve. A greater focus was placed on student-centered learning, and the need to tie course content to SLOs that develop knowledge, skills, and abilities that are transferable beyond one specific learning environment and were based on measurable evidence (Boud & Falchikov, 2005).

Within the United States, there are expectations from government and accrediting bodies that institutions should embody a *culture of assessment*, with attitudes and behaviors reflecting a support of assessment at all stages (Weiner, 2009). In K–12 schools, the Department of Education emphasizes assessment: the evaluation of courses and programs is at the forefront of the No Child Left Behind Act (NCLB) of 2001 and the more recent Common Core State Standards Initiative (National Governors Association, 2010) that has been adopted by many states. As for higher education, a 2002 *Greater Expectations* National Panel Report published by the Association of American Colleges and Universities (AACU) asserts that "assessment is part and parcel of the teaching/learning process" (Ramaley & Leakes, 2002, p. 39). Likewise, the Southern Association of Colleges and Schools (SACS) Commission on Colleges stresses the value of assessment, advocating for the *teaching-learning-assessment* cycle that begins with learning goals and opportunities and ends with using the results of as-

sessments to take action and inform new goals for student learning. SACS further underlines the focus on measurable SLOs, evidence-based assessment, and the need to inform educators on how to carry out successful, purposeful assessments that support a "culture of improvement and innovation" (Suskie, 2013, p. 1–6).

Assessment in ALA-Accredited Schools

Standards of graduate-level accreditation bodies reiterate the undergraduate-level emphasis on assessment. In 1992, the American Library Association (ALA) Office of Accreditation (OA) issued standards for the accreditation of many North American library schools that emphasize a continuous planning process involving the assessment of student learning as one of the primary criteria for accreditation (American Library Association, 1992). During a study for alternate means of teacher effectiveness, researchers at the University of South Florida developed an assessment model that focuses on SLOs as part of a "continuous improvement cycle" (Perrault, Gregory, & Carey, 2002, p.270). This cycle involves not only the creation of a mission, goals, and objectives, but encompasses a "system that includes determining desirable programmatic outcomes, measuring how well those outcomes are achieved, and applying results for improvement of program delivery" (Perrault *et al.*, p. 270). This framework and ones like it reiterate the fact that assessment of SLOs must focus not only on student achievement, but must also include a continuous review of the curriculum and teaching strategies to allow for "ongoing appraisal, to make improvements, and to plan for the future" (Applegate, 2006, p. 324).

Assessment is less standardized and visible at the graduate level in library and information science and for each ALA-accredited program compared to other professional degrees. LIS in North America operates with more variety than other fields due to diverging foci of individual programs' missions and clientele. Each new iteration of ALA standards remains influential to the overall demonstrations of student learning process within core courses at each school (Orzoff, Peinovich, & Riedel, 2008). Still, these standards focus on core courses taken by all students and do not directly inform the SLOs of electives offered in this multi-disciplinary field. With a lack of standards handed down from accrediting bodies or at the programmatic level for elective courses in the field, it is vital that instructors of these courses acknowledge the value of assessment, the instructor's role in the process, and the potential benefits of sharing some commonalities in SLOs. Instructors must carry out a type of assessment and continuously review their teaching methods and course material to ensure that students are gaining the knowledge, skills, and abilities from elective courses that will ultimately aid them in their studies and prepare them for their future careers.

This paper focuses on a course evaluation conducted via a value-added assessment. *Value-added* refers to changes in student learning over an interval of time, with students being subject to the same evaluation before and after a "higher education intervention" (Fulcher & Willse, 2007, p. 10). Value-added assessments are typically carried out through the use of pre-tests and post-tests. A 2006 Department of Education report states that "results of student learning assessments, including value-added measurements that indicate how students' skills have improved over time," are important factors in building successful educational systems (Spellings, 2006, p.24). The American Association of State Colleges and Universities (AASCU) likewise advocates for value-added methods, recognizing them as "viable measures" of student learning (Boyas, Bryan, & Lee, 2012, p. 429). As the use of pre-tests and post-tests increases, change scores witnessed from value-added methods can be used in conjunction with other means of

assessment to determine the overall effectiveness of courses and programs. For this type of change to be measured, SLOs must be developed and questions written to assess the outcomes.

Background

Within the field of library and information science, preparing students to work with geographic information is a growing area of focus, as the supply of and demand for geospatial data are both increasing (Bishop, Grubesic, & Prasertong, 2013). As a result, the Laura Bush 21st Century Librarian Program grant via the Institute of Museum and Library Services (IMLS) funded the *Geographic Information Librarianship* (GIL) project designed to bolster the data curation education of librarians and to improve their abilities to deal with the varied resources generated by geospatial tools at Drexel University and the University of Tennessee. The first step of the collaborative project between the two programs was to build a model that allows existing subject area core competencies and job incumbents to inform coursework. The survey validation approach has been used extensively by other professions, such as teaching, nursing, and law to inform curricula with empirical data from current workers (Raymond, 2005).

The survey validation used core competencies created by the members of the American Library Association's Map and Geography Round Table (MAGERT) in 2008. In response to the sea change of geographic information types and uses, the MAGERT Education Committee created the core competencies with the purpose "to assist in the professional development life cycle: from student/faculty curriculum development to new professional to mid-career professionals or others who are new to the specialization, as well as administrators or personnel officers to assist in job descriptions and hiring in this area" (MAGERT, 2008, p. 2). In 2011, members voted to change the name to the Map and Geospatial Information Round Table (MAGIRT) to reflect new focus and direction. The development of the core competencies included a draft created by twelve members of the Education Committee that was subsequently circulated to the Round Table's members (~300) for suggestions, and then a final document to guide future education endeavor for the group was available for educators and practicing librarians. This study used the core competencies to guide curriculum development, especially student learning outcomes.

By surveying practicing librarians, archivists, and other information professionals working with geographic information in 2012, mean scores were produced and the most important core competencies were adapted into SLOs for a subject area elective. A total of 157 librarians, archivists, and other information professionals working with geographic information responded to the survey. The findings led to the creation of SLOs used for this course-level assessment, and a more detailed discussion of the approach, findings, and discussion can be found in another publication (Bishop, Cadle, & Grubesic, 2015). This paper focuses only on assessment of existing SLOs derived from the survey validation study listed in Table 1.

These SLOs are derived from the most important survey validated core competencies from MAGIRT. This reduced set is necessary, in part, because covering the seventy-five original core competencies in one elective would be impossible. In addition, the course was an attempt to teach a broader range of information professionals working with geographic information.

Methodology

This paper provides actual value-added assessment results for these SLOs for one elective offered for the first time at these two iSchools. A pre-test/post-test was chosen to assess the SLOs as most fit neatly into questions with one clear answer (e.g., scale question: Which representa-

Table 1. Student Learning Outcomes from Survey Validation of Core Competencies.

Course Section	Total # of Courses
1. Geography and Cartography	1.1. *Students will demonstrate geographic and cartographic principles, including geographic and cartographic scale, projection, grids, and geographic coordinate systems*
2. Collection Development/Records Appraisal/ Collection Maintenance	2.1. *Students will demonstrate knowledge of local, state/provincial, federal and international mapping agencies and private map publishers, map series and similar publication patterns, and gazetteers, data portals, volunteered geographic information, and aspects of the Federal Depository Library Program*
	2.2. *Students will select strategies to obtain different types of maps, imagery, and other geospatial data*
	2.3. *Students will describe copyright considerations and the ability to negotiate licensing agreements for databases and collections of geographic information*
	2.4. *Students will explain how to assess the strengths and specialties in a collection and the needs of users to inform collection development*
	2.5. *Students will describe proper materials handling, especially for rare and fragile materials*
3. Reference and Instruction	3.1. *Students will demonstrate the ability to locate geospatial data and software support*
	3.2. *Students will gain awareness of GIS tutorials & training*
	3.3. *Students will develop and deliver geographic information consultations*
4. Metadata/Cataloging	4.1. *Students will explain metadata standards, schemas, and issues*
	4.2. *Students will understand and interpret existing metadata in geospatial records*
	4.3. *Students will define projections, coordinate systems, and other physical characteristics of cartographic items to create metadata records*
	4.4. *Students will interpret and calculate cartographic scale*

tive fraction shows "one inch equals one mile"?). The Geography and Cartography competencies were easily written because of the existing foundation developed by the University Consortium for Geographic Information Science and its Geographic Information Science &Technology Body of Knowledge (BoK) (DiBiase, DeMers, Johnson, Kemp, Luck, & Plewe, 2006). The BoK was consulted to inform SLOs related to Geography and Cartography because the MAGIRT core competencies

only included a simple paragraph detailing the obvious criticality of knowing these concepts. The BoK increased the effectiveness and standardization of GIS education by providing example SLOs and test questions to guide curriculum development and assessment (DiBiase *et al.*, 2006). An equivalent encyclopedic list of SLOs does not exist for library and information science, so the later three SLO sections and test questions for (2) Collection Development/Records Appraisal/Collection Maintenance; (3) Reference and Instruction; and (4) Metadata/Cataloging required writing new test questions. Table 2 provides course context of the corresponding sections and number of test questions.

Table 3 gives some detailed examples of how Student Learning Outcomes were written into test questions.

Once created, these test questions were used to assess student understanding of concepts in the elective class at Drexel and UT. Both programs are conducted online and the same course management software was used to administer the tests to all enrolled students. Students were invited to take part in a value-added assessment that consisted of two questionnaires (1) a pre-test in the first week of each course and (2) and post-test at the completion of the course. Students were informed that these tests would in no way affect their course grades and that participation in them was completely voluntary. Fortunately, 100% of students in each elective participated in both pre and post-tests—14 from the University of Tennessee and 11 from Drexel University.

Those students who chose to take part in the project completed the two tests that consisted of 30 multiple choice questions to be answered within a time limit of 60 minutes. The questions on the pre- and post-tests were the same within each course, allowing for a change score to be seen for each individual as well as at the course and overall project levels. Again, each question correlated to a specific SLO allowing for section- and outcome- specific findings to inform future iterations of the course where students learning varied. All results were kept confidential and anonymous and are reported here in the aggregate.

Findings

The findings from this value-added assessment in both electives are characterized in Tables 4–6. A total of twenty-five students completed the assessment within the two courses, and the average scores and changes from pre- to post-test are included as descriptive statistics. Table 4 provides the average pre-test / post-test scores from the two programs, as well as the average percentage of change in score (the quantitative value added) from pre-instruction to post-instruction. Table 5 characterizes average student scores within each course section and correlating SLO, allowing one to see the specific areas that were comprehended more fully and those that should be targeted in the next instance of the course. Table 6 breaks this down further, showcasing average student scores on specific objective sub-sections for both programs.

Doing a multivariate test with the pre-test and post-test results for both pro-

Table 2. Number of Test Questions Related to Each SLO Section.

Course Section	SLO	# of Test Questions
1. Geography and Cartography	1.1	12
2. Collection Development/Records Appraisal/Collection Maintenance	2.1–2.5	7
3. Reference and Instruction	3.1–3.3	5
4. Metadata/Cataloging	4.1–4.4	6

Table 3. Examples of Test Questions Correlated to Student Learning Outcomes.

Student Learning Outcome	Sample Test Question
1.1.	Which representative fraction shows "one inch equals one mile"? (a) 1:63,360 (b) 1:21,120 (c) 1:24,000 (d) 1:48,000
2.1.	_____ allows geospatial data and/or software to be disseminated to an institution's students, faculty, and staff who provide valid identification. (a) A site license (b) A single-use license (c) A general public license (d) A workstation license
3.1.	A remote sensing faculty member needs 1-meter orthoimagery for a rural part of the U.S. The data must be free and be able to be delivered quickly. Which resource would be best to meet this user's needs? (a) The National Map (b) GeoCommunity (c) MapServer (d) Web Map Tile Service
4.1.	The Content Standard for Digital Geospatial Metadata (CSDGM) increases the value of geospatial data by allowing researchers to do each of the following except: (a) automate metadata creation (b) avoid duplication of work (c) limit liability (d) create institutional memory

grams, we found a significant difference in the increase in scores (F (1,23) = 20.913, $p < .001$). The University of Tennessee students started off much lower, but caught up in the post-test to the Drexel University students. This may be because Drexel students had prior exposure to other GIS courses and content. However, we looked for differences across the two programs' overall scores, but that difference was not significant and as a result further analysis into differences between the two programs were not explored.

To inform how the course performed across its different student learning outcomes, we looked at pre-test/post-test differences for each of the four course sections. The t-test results show a significant change occurred for the Geography/Cartography ($p < 0.001$) and Metadata/Cataloging objectives ($p < 0.003$). However, the other two sections showed no significant change. This knowledge may be learned in other courses across the curricula in each program because topics and assignments related to Collection Development/Records Appraisal/Collection Maintenance and Reference and Instruction appear across courses as these are relevant throughout different types of information agencies. Although scores did increase for all four sections of the course, the student learning outcomes most specialized to this elective—Geography and Geospatial Metadata were those whose change was statistically significant.

Table 4. Average Scores and Overall Change from Pre-Test to Post-Test.

Program	Pre-Test Score	Post-Test Score	Overall Change
University of Tennessee	14.79 / 30	20.07 / 30	+ 5.28 points, or 17.6%
Drexel University	18.55 / 30	20.82 / 30	+ 2.27 points, or 7.5%
Combined	16.46	20.40	+ 3.94 points, or 13.1%

When comparing the pre-test and post-test results from the value-added assessment at each institution, one can see that the knowledge gained through the elective course was reflected in student achievement. Breaking down the scores by each objective (Table 6) shows that, in rare cases, scores did decrease from pre-test to post-test. Nevertheless, overall student scores improved for questions relating to each SLO (Table 5), and students at both programs raised their scores by an average of 3.94 points, or 13.1 percent (Table 4).

Conclusions and Implications

Despite much discussion on assessment in recent years there remains a gap in the literature, with few works presenting actual assessments or their results. This paper works toward filling this gap by offering a view of a real assessment as applied to a graduate elective course taught in two programs involved in North American LIS education. Using a value-added method and change scores on the courses' thirteen student learning outcomes, the instructors of each courses were able to compare the pre-test and post-test scores to measure improvement and to what degree this occurred. This approach not only allowed the instructors to immediately gage student knowledge via the pre-test, but will more importantly allow them to use the findings from the change scores when planning future iterations of the course. The results from this specific study demonstrate that the development of measurable, evidence-based SLOs and the implementation of a student assessment (value-added or otherwise) are valuable practices at the graduate level to improve student learning. With evidence of student understanding and information on gained knowledge, skills, and abilities, educators can better plan instruction and prepare students to succeed in the course, program, and into the workforce.

At the graduate level, methods of and reasoning for assessments tend to vary across fields and institutions. This is the case within LIS as well, with assessment of student learning at the institution, program, and course levels often dependent on local assessment requirements and in-

Table 5. Average Scores and Overall Change from Pre-Test to Post-Test by Section.

	Outcomes		
Course Section and SLOs	Combined Pre-Test Score	Combined Post-Test Score	Overall Change
1. Geography and Cartography (SLO 1.1)	6.69 / 12	8.56 / 12	+ 1.87 points, or 15%
2. Collection Development/Records Appraisal/Collection Maintenance (SLOs 2.1–2.5)	4.31 / 7	4.88 / 7	+.57 points, or 8%
3. Reference and Instruction (SLOs 3.1–3.3)	2.85 / 5	3.48 / 5	+ 0.63 points, or 12.6%
4. Metadata/Cataloging (SLOs 4.1–4.4)	2.38 / 6	3.48 / 6	+ 1.1 points, or 18%

Table 6. Average Scores and Overall Change from Pre-Test to Post-Test by Each SLO.

SLO	Combined Pre-Test Score	Combined Post-Test Score	Overall Change
1.1.	6.69 / 12	8.56 / 12	+ 1.87 points, or 15%
2.1.	1.88 / 3	1.64 / 3	– 0.24 points, or 8%
2.2.	0.54 / 1	0.56 / 1	+ 0.02 points, or 2%
2.3.	0.73 / 1	0.92 / 1	+ 0.19 points, or 19%
2.4.	0.85 / 1	0.80 / 1	– 0.05 points, or 5%
2.5.	0.81 / 1	0.96 / 1	+ 0.15 points, or 15%
3.1.	1.31 / 2	1.60 / 2	+ 0.29 points, or 14.5%
3.2.	0.58 / 1	0.36 / 1	– 0.22 points, or 22%
3.3.	0.96 / 2	1.52 / 2	+ 0.56 points, or 28%
4.1.	0.31 / 2	0.76 / 2	+ 0.45 points, or 22.5%
4.2.	0.85 / 2	1.36 / 2	+ 0.51 points, or 25.5%
4.3.	0.62 / 1	0.76 / 1	+ 0.14 points, or 14%
4.4.	0.62 / 1	0.60 / 1	– 0.02 points, or 2%

structor evaluations. Accrediting bodies, in the case of LIS the ALA Committee on Accreditation (COA), perform assessments of programs led by external practitioners and academics that determine whether each program qualifies for accreditation and meets their *Standards for Accreditations of Master's Programs in Library and Information Studies* (American Library Association, 2014). However, these national standards focus on the core competences covered in core courses and do not directly inform other SLOs that exist in a myriad of elective courses. This is especially the case within LIS, as its multi-disciplinary nature lends itself to a variety of electives and specialized topics that are not taught in every LIS programs. This specialization means electives are not even a secondary concern of COA standards, but those teaching in similar areas could benefit from cross program collaborations like this project to develop some standardization across the field's electives.

The results of this study demonstrate that creating SLOs and using them to evaluate teaching effectiveness is a valuable practice in elective courses, and a practice that could be standardized across graduate programs regardless of topic. While electives are varied within the LIS field, courses that cover common topics such as data curation, information visualization, data science, health informatics, bioinformatics, and geographic information are increasingly taught in greater number. The frameworks of such courses currently differ from program to program, and both the instructors and students would likely benefit from the standardization of SLOs across institutions which offer similar electives. This would allow for frequent assessment of student learning and the improvement of course content to better fill curricular gaps. Value-added assessments such as the one included in this study offer a simple, objective method of determining whether students have learned what the instructor intended for them to learn in the class. If paired with standardized SLOs, instructors could more effectively use their time to plan the course to best benefit students, and each program would not need to reinvent course objectives, SLOs, and evaluation wheels. Student success

should also increase as courses will be tailored to where most students are in terms of background knowledge and where personal student achievement advancements are needed.

Within the field of Geographic Information Science, the Geographic Information Science & Technology Body of Knowledge (BoK) was created to increase the effectiveness of GIS education, containing sample SLOs and test questions in the subject areas of geography and cartography. Similar to frameworks in other fields, this document guides coursework and student assessment by allowing instructors to build off of professional SLOs and effectively evaluate student learning. An equivalent BoK framework does not exist within LIS for the core courses or electives. While ALA does provide accreditation standards, an encyclopedic list of SLOs or assessment questions has not yet been created or adopted for use by LIS programs. *The Atlas of New Librarianship* offers a vision for the field that includes visual representations, statements about librarianship, and discussions of theory and practice (Lankes, 2011). Although this work should be commended, it is not designed to be a pedagogical assessment tool paired with standardized learning objectives and questions for the education aspects of the field.

As this study demonstrates, clear, effectual SLOs, and measurable, evidence-based assessments are important factors in developing and improving courses that in turn improve institutions and benefit all students. With this in mind, it is clear that the development of SLOs that can be measured, assessed, and put into practice would be beneficial to the LIS field, both within its core courses and its electives, as they would ultimately improve teaching effectiveness. This would allow for a cyclical approach to the teaching and learning experience, measuring weakness and strengths across the curricula by sharing this piece of the teaching workload across instructors in the same area.

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