How Digital Library Services Contribute to Undergraduate Learning: An Evaluation of the "Understanding Library Impacts" Protocol

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Abstract

"Understanding Library Impacts" is a qualitative protocol designed to investigate the ways library services and resources contribute to undergraduate learning using interviews with librarians, faculty, and students. The Critical Incident Technique (CIT) is used in the student interviews to identify aspects of library services and resources that are critical to student success. The Revised Taxonomy of Educational Objectives is used to classify faculty goals for student learning and student interpretations of these goals. An alignment process using these data is proposed to connect library contributions to institutional goals for student learning. This paper reports on a pilot study conducted in 2005 at a liberal arts college to evaluate the protocol. Results of the pilot study suggest the protocol can detect library contributions to institutional goals for student learning. Future studies should be carried out to evaluate the protocol in other post-secondary settings. The protocol should be of benefit to libraries seeking to improve library services and to communicate library contributions to institutional goals to stakeholders.

Introduction

Academic libraries in the United States need methods for understanding how library services contribute to undergraduate student learning and a means to communicate those contributions to higher education stakeholders. Stakeholders in higher education – policy makers, law makers, business interests, parents and students – demand that colleges and universities demonstrate public accountability through evidence an undergraduate education is of a quality that justifies its costs. In this context learning outcomes have become a principal deliverable of interest in higher education policy (Graham, Lyman, and Trow, 1995; Leef & Burris, 2001; U.S. Department of Education, 2006).

While academic libraries make essential contributions to undergraduate success, adequate tools for understanding and articulating the connections between library services and student achievement are needed. The Association of College and Research Libraries (ACRL) recognized the importance of this issue in the mid-1990s and formed a Task Force on Outcomes Assessment to address this issue. In 1998, the Task Force posed a challenge to the profession in the form of a simple question: "how are our users changed by contact with libraries?" (ACRL, 1998). Information literacy is one direct result of student contact with library services and resources and in 1999 Information Literacy Competency Standards for Higher Education were suggested, debated, and finally approved by the Association of College and Research Libraries (ACRL, 1999). These standards and performance indicators have driven much of the library-centered outcomes assessment work to date. And the 2004 revision of the ACRL Standards for

College Libraries (ACRL, 2004) emphasized demonstrating alignment of the academic library mission with institutional goals and evaluating library success through outcomes assessment.

Over the past twenty years academic libraries have invested heavily in electronic resources and digital infrastructure to meet the information needs of their patrons. As the proportion of academic library expenditures spent on digital resources and services continues to increase (ARL, 2004) it is natural for stakeholders to ask how these expenditures contribute to institutional goals. Locally gathered and vendor provided statistics demonstrate that students are using library provided electronic resources. Yet statistics alone cannot aid in understanding how student use of electronic services contributes to academic success.

The "Understanding Library Impacts" protocol addresses these challenges by focused application of qualitative methods to investigate student achievement of learning goals important to the college or university. First, a series of interviews with librarians and teaching faculty allows the researcher/evaluator to understand the diversity of library resources available to students and the learning goals embedded in a given undergraduate curriculum such as English, Engineering, or Nursing at a specific institution. Student interviews using the Critical Incident Technique (CIT) help understand student perceptions of the learning goals associated with the curriculum and the aspects of library services and resources that impact student achievement. The CIT is a well-established qualitative technique for detecting "nuances of quality that are lost in most survey data collection" (Radford, 2006). Second, a language of learning outcomes based on the Revised Taxonomy of Educational Objectives (Anderson, 2001) ties student observations regarding library impact to institutional goals for student learning.

In 2005, the "Understanding Library Impacts" protocol was evaluated at Davidson College in Davidson, North Carolina to assess its viability as a tool for understanding digital library service and resource contributions to undergraduate learning.

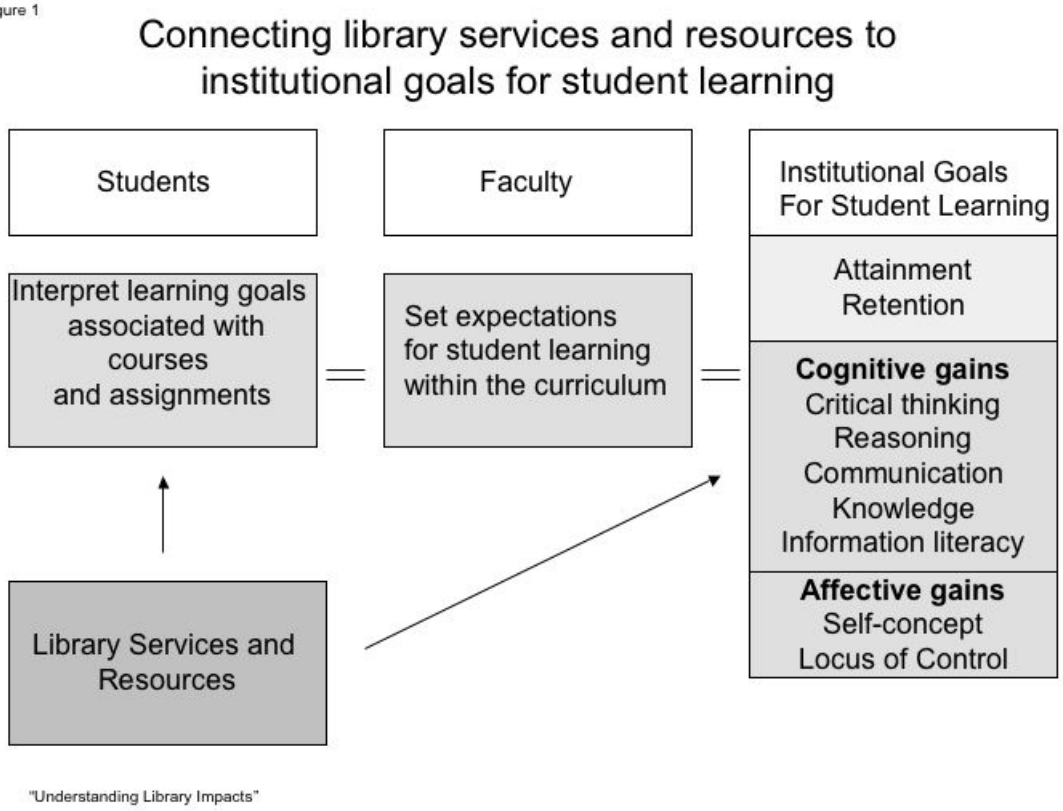
Research Design

The "Understanding Library Impacts" protocol uses interviews with faculty and students to make these connections within the context of an academic major or program. Interviews with faculty reveal the curricular goals associated with the courses and assignments central to a given academic major. Interviews with students in a given major reveal student perceptions of the learning goals associated with the curriculum and how library services and resources aid in student achievement. A comparison of the faculty and student statements regarding learning goals tests alignment of the student observations with institutional goals for learning. Alignment between faculty goals for learning and student perceptions of those goals connects library contributions to student achievement to institutional goals for student learning.

Figure one demonstrates how the "Understanding Library Impacts" protocol makes this connection. Institutional goals for student learning are arranged on the right. First there are the easy to measure outcomes like retention and attainment, and then come

cognitive goals like critical thinking and affective goals like changes in attitude, increases in confidence, and identification with a discipline (Astin, 1973; Pascarella and Terenzini, 2005). In the center column are the learning goals defined by faculty within a specific academic discipline. An assumption is that faculty defined goals serve as a proxy for institutional goals for student learning within a given discipline. Data from the student interviews include student perceptions of the learning goals associated with their academic work and the ways library services and resources contribute to their achievement. Alignment between student and faculty observations regarding curricular learning goals ties library contributions to institutional goals for student learning.

Figure 1



Data collection and analysis

Data collection consists of three sets of interviews:

1) A focus group interview with librarians is used to understand the library and its goals for digital library services. Other data gathering methods can be useful including examination of annual reports, strategic plans, and familiarity with the library's web site.
2) Interviews with teaching faculty in a particular discipline such as History, English, or Business help understand the learning objectives associated with the undergraduate curriculum for students majoring in that discipline.

3) Interviews with student majors using the Critical Incident Technique (CIT) (Flanagan, 1954; Radford, 2006) focus on students' academic experiences. These interviews seek to understand students' perceptions of the learning goals associated with their academic work and the contributions library services made to that achievement.

The interviews are recorded, transcribed, and analyzed for recurring themes. Codebooks are derived from the recurring themes and applied to the transcripts. Inter-rater reliability testing was conducted with 25% of the transcripts to evaluate and improve the coding.

Central to the analysis is a language of learning outcomes that has validity within the field of educational research and credibility with campus and external stakeholders. The Taxonomy of Educational Objectives is well known in educational research as a classification system for statements regarding learning objectives. The Taxonomy was first developed in the 1950s by a group of educational and psychological researchers led by Benjamin Bloom (Bloom, 1956). "The taxonomy serves as a framework for classifying statements of what we expect or intend of students to learn as a result of instruction (Krathwohl, 2002)". The original taxonomy classified learning objectives in six categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation.

In the late 1990s, the Taxonomy was revisited and revised (Anderson & Sosniak, 1994; Anderson et al., 2001). In the Revised Taxonomy (Appendix A), learning objectives are classified in knowledge and cognitive process dimensions. The knowledge dimension represents the "noun" or content of learning and the cognitive process dimension reflects the "verb" of learning. For instance, consider the statement "a student shall be able to explain Newton's third law." The verb of the statement is "to explain" which implies understanding and the noun of the statement includes the concepts related to the conservation of momentum. For purposes of illustration or comparison, both the "verb" and the "noun" of this learning objective can be mapped to a cell in a taxonomy table.

Table 1. Taxonomy Table

"a student shall be able to explain Newton's third law."

	Cognitive Process Dimension					
Knowledge Dimension	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
A. Factual Knowledge						
B. Conceptual Knowledge		X				
C. Procedural Knowledge						
D. Metacognitive Knowledge						

In this study, the taxonomy table serves as the vehicle for connecting faculty observations regarding student learning goals and student interpretations of those goals. After classifying faculty and student statements regarding learning objectives using the Revised Taxonomy, each knowledge-cognitive process pair can be mapped to a cell of the table. Once filled, the table can be used to compare the distributions. Similar distributions indicate the students and faculty are referencing a similar set of learning

objectives, which connects the students' accounts more directly to institutional goals for learning within the academic program or undergraduate major of interest.

Pilot Study

The pilot study was conducted at Davidson College. Davidson College is a selective liberal arts college in Davidson, North Carolina attended by approximately 1700 students. The college library is located in the center of campus literally and figuratively. Faculty-library collaboration levels are high and students are heavy users of traditional and digital library services and resources. Data collection for the pilot began in late summer 2005 and concluded in November 2005.

Step one involved a focus group interview with five librarians. The discussion focused on the digital library services and resources Davidson provides for students and librarian perceptions of the benefits students may enjoy in their use. A wide range of digital library services and resources were mentioned including finding aids such as library catalogs and indexes, licensed and locally produced databases of articles and images, and digital infrastructure and productivity tools. Librarians anticipated that extended access to information and convenience of access were significant benefits appreciated by students. Digital resources extend access by enabling students to locate information via multiple access points and interfaces, to use those sources independent of time or geography, and ultimately to access a wider range of resources than would be feasible with traditional print resources. Convenience is expected to take the forms of timesavings, and time and space independence. The librarians also expressed concern that convenience, above other factors, may drive student demand for and use of services. That is, students may prize resources that are easier to find and access above those that are best for their academic work.

Step two involved interviewing members of the teaching faculty. Four faculty members from across the college in the Humanities, Social Sciences, Sciences, and the Fine Arts were invited to participate. They are each known for their dedication to teaching, service, and research. Two were male and two were female and each teaches first-year through senior seminar level courses. The interview discussions focused on the courses they teach, the assignments students complete in the courses, and the learning objectives associated with each assignment.

Primarily, the assignments discussed involved communicating knowledge through writing (14), speaking (6), and creating a web page (2). Other assignment types included gathering data (2), conducting experiments (2), and tests and quizzes (3). Statements regarding learning goals associated with each assignment were classified using the Knowledge and Cognitive Process dimensions of the Revised Taxonomy. Sixty-five statements regarding learning objectives were gathered and unambiguously classified according to the Revised Taxonomy. The faculty distribution is presented in table 2. Clusters are present in the areas of applying procedural knowledge (finding and locating information resources, carrying out experiments, using appropriate documentation styles, etc.), analysis (critical thinking, evaluating sources) and analyzing, evaluating, and creating conceptual knowledge (critical thinking, writing a research paper, developing a thesis statement, designing an experiment).

Table 2. Taxonomy Table -- Faculty observations regarding Learning Objectives (n=65)						
	Cognitive Process Dimension					
Knowledge Dimension	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
A. Factual Knowledge		1 (1.5%)	1 (1.5%)			
B. Conceptual Knowledge		4 (6.3%)	1 (1.5%)	8 (12.8%)	6 (9.5 %)	7 (11.1%)
C. Procedural Knowledge			14 (22.2%)		2 (3 %)	7 (11.1%)
D. Metacognitive Knowledge			1 (1.5%)	1 (1.5%)	2 (3 %)	8 (12.6%)

These findings demonstrate the feasibility of using the Revised Taxonomy to classify faculty statements regarding learning objectives. In future studies the process can be evaluated within a specific subject domain.

Student Interviews

A sample of ninety-six students stratified by academic year, gender, race, and academic major received email invitations to participate in this phase of the study. Twelve students accepted the invitation and participated in interviews during the summer and fall of 2005. Ten of the participants were female and two were male. All of the respondents were white. One student was of Hispanic origin. Eleven of the students had declared a major at the time of the interview. Fifty percent of the students in the sample majored in the humanities and 33% majored in Biology. Ten of the twelve participants were enrolled as seniors or graduated from the institution in 2005.

Survey of library use

The students were also asked to complete a brief survey regarding their library use. This encouraged the student participants to think back over their academic experience so they would have projects in mind for the second part of the interview and to help the researcher understand the library use trends in the sample. Answers to the survey questions are displayed in table 3. These responses indicate familiarity with and a willingness to use library services among this sample. Though data are not available for the entire population at the institution, these seem to be heavy users of the library's services. In future studies, this data could be gathered from a representative sample of the population by a questionnaire to determine if the library usage patterns of participants in the interview portion of the study are typical of the population as a whole.

Table 3. Student use of library services and resources	Min	Max	More than once per week	Weekly	Once or twice per month
Check out books	2	5	17%	58%	92%

Use print periodicals	2	5	17%	50%	92%
Study or conduct research in the libraries	5	5	100%	100%	100%
Seek research help from a librarian	1	4	0%	17%	67%
Use a computer in one of the libraries	4	5	83%	100%	100%
Use the library catalog to locate materials in the libraries	3	5	33%	83%	100%
Use electronic indexes or databases	2	5	50%	83%	92%
Use electronic journals	2	5	25%	50%	83%
Use Course Reserves	2	5	33%	67%	92%
Use an electronic form to communicate with a library staff member	2	5	8%	25%	75%
1 = Never, 2 = Once per semester, 3 = Once or twice a month, 4 = weekly, 5 = more than once per week.					

Student Perceptions of Learning Objectives

During the interviews students are asked to discuss a significant academic assignment or project. Cumulatively, the participants discussed 33 projects or papers. Each interview was transcribed and analyzed for emergent themes regarding their perceptions of the learning objectives associated with each assignment and how students used library services and resources to achieve those goals. Overwhelmingly, the assignments involved writing in the form of research papers (24) and theses (6). Grant proposals (2), lab reports (2), non-academic projects (2), presentation (1), summer job (1), and creating a web site (1) rounded out the list.

Next the student perceptions regarding learning objectives associated with each assignment were classified using the Knowledge and Cognitive Process dimensions of the Revised Taxonomy. Twenty statements were classified as Applying Procedural knowledge. The remainder of the apply objectives mentioned procedural knowledge including writing skills, discipline specific document formatting techniques, locating relevant resources, web design skills, and experimental procedures.

Nine (75%) of the students mentioned learning objectives that could be classified as analyzing conceptual knowledge in sixteen (27%) of the incidents. Analysis of texts, analyzing works of art, and interpretation of findings were all mentioned in the passages. A term often used for this objective is “thinking critically” or “critical thinking” such as “The main purpose was to see what historians go through and to think critically about things we read on a given event” (ST-P-1-A). Analysis is also the basis for higher order objectives like evaluating and creating: “I like writing plays but you have to ground it in research and analysis” (ST-P-09-C).

Twenty percent of the incidents included passages that mapped to the Create dimension. Nine (75%) of the students in the study mentioned objectives which could be mapped to this dimension. This theme emerged often in discussions of theses where student explicitly mentioned the purpose of their work was to create new knowledge. The following passage expresses this theme well: "Filling the gap is what they call it … So you have to write about something no one has ever written about" (ST-P-06). Creation also emerged in the discussions of mock or real grant proposals (2).

Table 4. Taxonomy Table -- Student interpretation of faculty expectations mapped to knowledge and cognitive process dimensions						
	Cognitive Process Dimension					
Knowledge Dimension	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
A. Factual Knowledge		4 (6.6%)				
B. Conceptual Knowledge		5 (8.3%)	1 (1.6%)	16 (26.6%)	2 (3.3%)	11 (20%)
C. Procedural Knowledge			20 (33.3%)			
D. Metacognitive Knowledge						

Comparing the distributions of learning objectives

The next table demonstrates the use of a Taxonomy table to compare the faculty and student perceptions of learning objectives. The distributions are similar in several ways. Both distributions show clusters along the Conceptual Knowledge dimension reflecting an emphasis on understanding, analyzing, evaluating, and creating conceptual knowledge. A second area of overlap can be seen in the Applying Procedural knowledge cell. Also, neither group mentioned statements mapping to the Remember cognitive process dimension. Alignment in this study suggests the utility of this protocol for future studies comparing faculty and student observations regarding learning outcomes within a given discipline.

Table 5. Taxonomy Table demonstrating the frequencies of faculty and student observations regarding learning objectives						
Faculty *n* = 65 Students *n* = 60						
	Cognitive Process Dimension					
Knowledge Dimension	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
A. Factual Knowledge		F 1 (1.5%) S 4 (6.6%)	F 1 (1.5%) S 0 (0%)			
B. Conceptual Knowledge		F 4 (6.3%) S 5 (8.3%)	F 1 (1.5%) S 1 (1.6%)	F 8 (12.8%) S 16 (26.6%)	F 6 (9.5%) S 2 (3.3%)	F 7 (11.1%) S 12 (20%)
C. Procedural Knowledge			F 14 (22.2%) S 20 (33.3%)		F 4 (8.3%) S 0 (0%)	F 7 (11.1%) S 0 (0%)
D. Metacognitive Knowledge			F 1 (1.5%) S 0 (0.0%)	F 1 (1.5%) S 0 (0%)	F 2 (3%) S 0 (0%)	F 8 (12.6%) S 0 (0%)

Using library services and resources to achieve academic goals

In the next part of the interview students were asked what library services were used to complete their assignments. All of the students interviewed reported using digital library resources a total of 108 times in 88% of the projects. This category includes

electronic finding aids such as the library catalog and discipline specific indexes, full-text articles databases, and digital infrastructure like computers in the library or the OpenURL resolver. Eleven of twelve student participants reported using traditional resources such as books, print indexes, and print periodicals and traditional services including reference and research consultations. Also of interest is the relative non-use of electronic means to communicate with librarians as seen in the digital services row in table 6.

Table 6. Student reports of library use by type	Number of statements	Number and percentage of students	Number and percentage of projects
Digital Resources	108	12 (100%)	20 (88%)
Traditional Resources	34	11 (92%)	18 (54%)
Digital Services	5	4 (33%)	5 (15%)
Traditional Services	46	11 (92%)	30 (91%)

Aspects of digital resources that contributed to student achievement

Students were next asked what aspects of a given service or resource helped or made it more difficult to accomplish academic goals.

When discussing digital resources students mentioned general benefits eleven times. Interviewee five stated for instance, "Without digitized materials it [paper] would have been a mess" (ST-P-05). As predicted by the librarians, students do value the convenience of digital library resources. There were seventeen references made to convenience in three areas. Several students mentioned time savings like student interviewee eight who said "Our professor gives us the citation and you have the case right there" (ST-P-08). Geographic and time independence were frequently mentioned as in the following statement "I do most of my work between midnight and 5 a.m. in my dorm room … I don't have to worry about the library being open" (ST-P-11). Finally subsidized printing offers monetary savings: "Course reserves saves …photocopying charges" (ST-P-05).

The user interface of a digital library resource interface can help students or serve as obstacles to academic achievement. Twenty-four statements regarding interfaces were gathered. Electronic finding aids offer significant advantages over print equivalents and these are appreciated by students like interviewee eleven who said "A lot of times they are easier to search with digital search functions that you can't do with a book" (ST-P-11-C). Enhanced content in electronic resources including article abstracts and enriched catalog records makes determining the relevance of information resources easier for students. Interviewee three noted "A lot of articles that pop up have a synopsis, so you don't have to read the whole article to know if it is good for your paper" (ST-P-3). In six instances, a digital library resource interface was an obstacle to achievement. For

instance several students mentioned difficulties encountered in searching an image database.

Convenience and ease of use both contribute to enhanced access to information that otherwise wouldn't be available without digital library resources. Thirteen statements were made regarding enhanced access. Digital library resources aid students by bridging geographic boundaries: "The document itself is in a museum. I would never have found it if it hadn't been scanned and I could just click on it" (ST-P-12). The content of digital library resources often enhances the breadth of materials that are available to students in terms of language diversity and currency. This access gives students more choices in what topics they select for projects as noted by participant six: "[Digital resources] really help people to write on a variety of things, instead of focusing on whatever we have … in the library" (ST-P-06-A).

Aspects of traditional services that contributed to achievement

Thirty-two passages mentioned the use of traditional library services including reference services, library instruction classes, research consultations, and interlibrary loan. Students benefited from these services in several ways. Advice in reference interviews and research consultations helps students locate relevant materials as noted by interviewee four "I mean I could have spent a week figuring out which [topic] had more information but I think the librarian really helped me" (ST-P-4-B) and eleven "Not only does the library have a structure that helps you find information really quickly, but there are people who … know the structure pretty well and can help you" (ST-P-11-C). Librarian approachability was an important factor contributing to student willingness to approach the reference desk and get needed help.

Library instruction was explicitly mentioned by six of the interviewees. The chief benefits received from this service are opportunities to gain facility with research tools and to learn when to use specific tools. Particular mention was made of gaining skills with digital library resources: "The librarian showed us how to use Biological Abstracts and how to narrow down our research. It was helpful" (ST-P-07). Some noted that the service had helped with a specific assignment: "And then the librarian had us just search … and I ended up finding almost all of the resources that I cited … in that 20 minutes in the room" (ST-P-2-A). Others discussed a more cumulative effect from attending library instruction classes where experience and instruction builds over time to improve their expertise as researchers (ST-P-12).

Increasing confidence and alleviating anxiety

Students mentioned building confidence or reducing anxiety in twenty-three passages. Factors contributing to an increase in confidence include practice with the research process or specific tools (6), gains in skill (1), familiarity with resources and prior success (4), and expertise from a librarian (6).

Practice using resources resulting in gains in skill were cited in seven incidents. Practice with Lexis –Nexis increased the speed with which information could be found (ST-P-2-B) and increased confidence for the next project, "I actually learned the best way

to search on those online databases. … I feel like I'm better prepared for research because of that research paper" (ST-P-2-B). Practice does not produce more effective research skills overnight, but progress is built throughout the academic career as noted in these quotes:

> "Most of what I learned came from applications, doing class research and things. That really helped a lot" (ST-P-11-C).
> "Since I've been here, I have had to learn my way around. It has been a learning process." (ST-P-7-B)

A lack of familiarity with finding tools is a source of anxiety and an obstacle to achievement. "I think a lack of information about what resources are available to find information is an [impediment?] to learning" (ST-P-09-B). Gaining familiarity with the research environment had the effect of decreasing anxiety and increasing confidence. Interviewee two indicated that "Once I knew where something was I sort of automatically felt more comfortable using it" (ST-P-2-B) and interviewee ten noted, "Yes … by junior year you are a lot more comfortable with it and confident with it and knowing where to go," (ST-P-10-B). Once a student is comfortable using a resource, they will be more likely to use it in the future and make it a part of their "toolbox" as described by interviewee twelve:

> PI: "What about the mechanics of Historical Abstracts? How does that work for you?
> ST-P-12-A: "I just know how to do it … I know what to look for and where to find it so it makes it a lot faster." (ST-P-12-A)

Students said that advice and interactions from a librarian contributed to increased confidence in nine passages. Reference contact in particular eased anxiety: "So I always felt that if I spoke with a librarian first, it calmed my anxiety, no matter how many classes or reference visits you go to, they can always pull things up" (ST-P-06-C). Regular interactions with librarians contribute to confidence and achieving independence as a researcher: "It helps to have the research consultation every year. I mean because I have built this up [skill] over time …" (ST-P-12-C). The approachability of librarians plays an important role here. Two students explicitly noted that the approachability of librarians at the pilot institution contributed to their being comfortable doing research and decreasing anxiety.

The Case of Emily

The development of student sophistication in performing research and achieving academic goals emerged as a theme early in the study. Common threads in these stories include a desire for independence as a researcher and overcoming barriers to achieve this independence. As observed in this study, library services and resources contribute to these changes over the duration of an undergraduate's career.

A review of the experiences of interviewee 6 will help demonstrate library contributions to student learning. Interviewee six is "Emily." She is a senior History major and she discussed her senior thesis during her interview. Her project included a

historiography, drafts of thesis chapters, and writing the paper. The learning goals for this assignment included developing an original problem statement, applying research skills to locate evidence to support the thesis, and writing the thesis. The goals map to the Revised Taxonomy dimensions of understanding and applying procedural knowledge, analyzing conceptual knowledge, and creating conceptual knowledge.

Barriers to Emily's success

Students mentioned three barriers to success in this study: a lack of awareness of resources relevant to research, a perceived lack of research skills, and research anxiety. Emily was aware of library resources and services, but she perceived that there weren't adequate materials to complete her work and Emily tells us herself that this causes anxiety:

> "You are already anxious and if you go in with this topic and nothing is coming up you are going to get very nervous and wonder if maybe there is not enough information on this topic …"

Emily also knows she needs to improve her skills and she is aware that she needs help from librarians, in this case in the form of a research consultation. "I had two library consultations right away." This is where she was introduced to methods of searching and resources for her project. She also seems to have had a library instruction session or two in her time at the college.

> "It depends on what classes you take, but a lot of professors take you for a session in the library electronic classroom … "

Her work with the librarian in the research consultations did more than introduce her to the resources – the contact seems to have helped alleviate her anxiety:

> "But when I was shown how easy it was to actually locate things, I was put at ease."

Emily uses a wide variety of information resources including the library catalog, electronic and print indexes for finding aids, books and periodicals from the print collection, microfilm and digitized newspapers, and she used interlibrary loan to request many of the microfilm reels. There were several aspects of these services that contributed to her academic achievement.

Aspects of user interfaces enhance Emily's access to information sources. For instance, Emily used the Historical New York Times Online, about which she said "I liked how you could see the ads around an article and you could put it in context." She also mentioned using hyperlinked subject headings within a library catalog record to locate relevant materials: "It was nice when it came up with the sub-heading and so you could click on those and narrow down your search." Digital tools often provide increased access to materials because of superior search engines as Emily used "broad searches to find articles that I knew were out there but I wasn't positive of their names." We often

think of interface as being a "computer" term but the user interface of other types of materials like print periodical indexes can enhance access to information as well:

> "I know we have it online, but sometimes I like flipping through it and having it right near me. … Sometimes if I wanted something specific I would look under my topic *[in Reader's Guide]* for that year and write down a few of the things under that term."

Emily noted that convenience associated with the use of digital library resources enhance access to needed information. In her case, JSTOR and digital document delivery via interlibrary loan gave her ready access to scholarly articles on her topic whenever she needed them. "We always needed scholarly articles … and I could always find them in JSTOR. They have everything" and "I would get the ILL request through the Internet and click on the PDF and the article is right there … much better than having to wait for the article to come in [by mail]."

The perception of access is not enough, but student success depends on item availability as well. Availability of digital resources can sometimes be assumed but not so with physical items when Emily says "Most of the time the books were where they were supposed to be." And the availability of space for studying is also important. "There is a carrel in the basement I have used since I was a freshman … I always worked well in the basement." The lack of availability can be a source of frustration. In this case, Emily found access to computers a problem:

> "People started writing papers down there on the computers and I wanted to put up a sign saying 'these were for research.' There should be something … if you need to search you can access it quickly."

A common source of anxiety for students was the perception that needed information would not be available. Access and availability are factors that help alleviate this sense of anxiety. Emily expresses this by noting

> "People from the beginning you want to feel that there is a lot there. Having the resources and being able to pull things up quickly, you know, going downstairs and it is right there."

To summarize, Emily must overcome two barriers, anxiety and a perceived lack of skill, to achieve the learning goals associated with writing a thesis. These learning goals include of understanding and applying procedural knowledge, analyzing conceptual knowledge, and creating conceptual knowledge. Her interview helps us understand that she used digital and traditional library resources along with the help of librarians. From these resources and services she appreciated the benefits of access, availability, and advice that helped her gain the confidence and skill needed to complete her thesis.

Conclusion

This evaluation of the "Understanding Library Impacts" protocol demonstrates the utility of qualitative research techniques for exploring and understanding the aspects

of library services and resources that contribute to student learning. The protocol also applies a language of learning outcomes valid within the educational research community to connect library services and resources to institutional goals for undergraduate learning.

The Critical Incident Technique (CIT) was evaluated for its sensitivity to detect the aspects of library resources and services that contribute to or inhibit student achievement. The technique was applied in twelve student interviews where students discussed learning goals associated with academic assignments and the ways library services contributed to or inhibited success. Students used digital library resources, used traditional library resources, and participated in face-to-face interactions with librarians to achieve their goals. Aspects of resources that were important include convenience, aspects of user interfaces, enhanced access to information, and availability of resources. Students benefited from interactions with librarians in library instruction, reference interviews, and research consultations. In these interactions students received advice, instruction, and encouragement that improved their skill and alleviated anxiety.

The Revised Taxonomy of Educational Objectives was evaluated as a framework for classifying faculty and student observations about learning goals associated with a curriculum. Faculty and student statements regarding learning goals were classified unambiguously using the Knowledge and Cognitive Process Dimensions of the Revised Taxonomy. Mapping the statements to a taxonomy table allows the researcher to compare the distributions. A finding of alignment may indicate students are referencing institutional learning goals within an academic major or curriculum. Future studies are needed to evaluate the protocol with students majoring in a particular academic discipline.

Implications

The "Understanding Library Impacts" protocol shows promise as an evaluative tool for librarians seeking a qualitative method for "getting behind the numbers" to understand and articulate academic library contributions to undergraduate student achievement. This protocol and similar efforts can aid administrators in two ways. Administrators and decision makers can use an understanding of the aspects of library services and resources critical to student success to refine services to meet student needs. Findings can also be used to communicate library contributions to institutional stakeholders. For instance, after a successful implementation of this protocol, one can imagine saying to a dean or a trustee:

> "Undergraduate students at our institution use library resources and services to complete assignments that help them achieve learning objectives as defined by the teaching faculty of our institution. Not only can I tell you that students use the library to achieve these objectives, but now I can tell you how … please listen to these stories …"

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Works Cited

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Appendix A. The Knowledge and Cognitive Process Dimensions of the Revised Taxonomy of Educational Objectives.

The Types and Subtypes of the Knowledge Dimension	
Factual Knowledge - Knowledge of terminology - Knowledge of specific details and elements	The basic elements students must know to be acquainted with a discipline or solve problems in it
Conceptual Knowledge - Knowledge of classifications and categories - Knowledge of principles and generalizations - Knowledge of theories, models, and structures	The interrelationships among the basic elements within a larger structure that enable them to function together
Procedural Knowledge - Knowledge of subject-specific skills and algorithms - Knowledge of subject-specific techniques and methods - Knowledge of criteria for determining when to use appropriate procedures	How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods
Metacognitive Knowledge - Strategic knowledge of techniques that are relevant in a given context - Knowledge about cognitive tasks including appropriate contextual and conditional knowledge - Self-knowledge and awareness of one's strengths or weaknesses	Knowledge of cognition in general as well as awareness and knowledge of one's own cognition
Adapted from Anderson, Krathwohl et al. (2001) A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives	

The Categories of the Cognitive Process Dimension and related Cognitive Processes	
Remember - Recognizing - Recalling	Retrieve relevant knowledge from long-term memory
Understand - Interpreting - Classifying - Summarizing - Inferring - Comparing - Explaining	Construct meaning from instructional messages, including oral, written, and graphic communication
Apply - Executing - Implementing	Carry out or use a procedure in a given situation
Analyze - Differentiating - Organizing - Attributing	Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose
Evaluate - Checking - Critiquing	Make judgments based on criteria and standards
Create - Generating - Planning - Producing	Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure
Adapted from Anderson, Krathwohl et al. (2001) A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives	