

Retaining Students by Embedding Librarians into Undergraduate Research Experiences

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Abstract

Purpose

The purpose of this paper is to identify an important area for librarians to positively impact student retention.

Design/methodology/approach

This programmatic and conceptual piece describes how embedding librarians into the growing enterprise of undergraduate research experiences (UREs) lays a framework for a context in which libraries and librarians directly contribute to the retention of undergraduate students.

Findings

Librarians are capable of directly contributing to the retention of students. While their efforts, it is contended, contribute routinely and to the actual retention of students, it is difficult for their efforts to register in the assessment of retention used by administrators. This discrepancy can be solved if librarians play a more explicit (and quantifiable) role in retaining students.

Research limitations/implications

UREs are a growing, but generally untapped trend for librarians; however, because UREs generally correlate with academic success and student retention, they offer librarians a useful entry point to contribute to the academic mission of colleges and universities, and in a measurable way.

Practical implications

Embedded librarianship poses a number of hurdles for its practitioners; however, it also has the potential for libraries and librarians to become more explicitly connected to overall institutional goals and strengthen their positions in the academy more broadly.

Social implications

Improving the scientific literacy of undergraduate students and aiding them on their path toward graduation is meaningfully enhanced through the embedding of librarians into the college curriculum.

Originality/value

Systematically embedding librarians into UREs is not strongly represented in the literature.

Keywords

Academic libraries, Librarians, Librarianship, Embedded librarians, Student retention, Undergraduate research

Paper type: Case study

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Introduction

The library is a crucial component of contemporary higher education. However, when it comes to mission critical solutions to the pressing problems, such as student retention, securing external funding for research, and the general push for student-centeredness, it is difficult to assess (i.e., quantify) the library's contribution. One potential solution to this problem for library leadership is to join a growing trend to embed librarians, and measure resulting student success. While many people are actively developing models of how librarians can embed themselves throughout colleges and universities, the focus here will be on a neglected topic: embedding librarians into undergraduate research opportunities. By marrying a growing trend in libraries (i.e., embedded librarianship) with the growing need in higher education for enhanced student-centeredness (e.g., through the expansion and improvement of undergraduate research opportunities offered by faculty), librarians can directly contribute to student retention, help secure external funding for research, and aid the general push toward increased student-centeredness.

This paper will first review the relevant literature concerning embedded librarianship, undergraduate research experiences, and the role that libraries can have in promoting student retention, in order to provide the proper context for discussing the issues. Implications for the profession will be discussed, along with some practical measures for librarians wishing to embed. Then a case study of an embedded librarian in such an undergraduate research experience will be presented in order to illustrate the benefits to students and librarians. This will be followed by a proposed framework for a first year seminar based on lessons learned in order to stimulate thought on how librarians can contribute to this rich new opportunity.

Literature Review

Embedded Librarianship

Embedded librarianship is the subject of a growing literature, and is generally considered one of a number of viable options for the future of the profession (Becker, 2010; Dewey, 2006; Knapp, 2012; J.A. Knapp et al., 2012; Siess, 2010). Although the term itself dates back only to the early 2000s, the embedded librarian concept, i.e., where a librarian partners with researchers outside of the traditional library environment, can be dated back to the 1970s with medical librarians taking the lead (Shumaker, 2009). Other terms in use for similar arrangements are “informationist” (Cooper, 2011; Davidoff and Florance, 2000; Rankin et al., 2008; Thomas et al., 2012) and “clinical librarian” (Brady and Kraft, 2012; Kesselman and Watstein, 2009). The embedded librarian model can be viewed as a response to the current working environment that many librarians face wherein they need to meaningfully engage with faculty members and undergraduate students.

It is important to recognize, however, that “being embedded” is defined a number of different ways. There has been a growth in librarians embedding in online courses via course management systems (Bennett and Simning, 2010; Kesselman and Watstein, 2009). Providing office hours and reference services outside of the library, among students and faculty, has also been documented (Clyde and Lee, 2011). Librarians are also becoming more involved in primary research by integrating into teams of researchers (Kesselman and Watstein, 2009; Robinson-Garcia and Torres-Salinas, 2011; Shumaker, 2012).

While academic librarians are enthusiastic supporters of information literacy standards (e.g., Association of College & Research Libraries, 2000; SCONUL Working Group on Information Literacy, 2011), they often have little access to students in a classroom environment, and especially limited access to students in special curricular arrangements such as independent studies or undergraduate research experiences. Some colleges and universities have established library orientation programs, although others do not; either way, this still leaves librarians in the difficult position of “selling” course instructors on the benefits of library instruction for them, their classes, and their students.

The instruction services offered by librarians are usually utilized as a “one-shot” teaching proposition, where a librarian teaches a single in-class session to an introductory or lower-division course with little or no opportunity to back up their lesson with an assignment or course reading. Even in innovative research-based first-year seminars, the goal of “enhancing [students’] internet and library research skills” translates to a relatively straightforward single “lecture given by a reference librarian” (Firmage et al., 2007, pp. 89, 94). As a result, the librarian is left to teach, as quickly as possible, the bare necessities of how to use their institution’s library system, discuss the benefits of scholarly journals, and show students how to navigate a handful of specific online databases. Basically, the librarian is treated more as an “add-on” rather than being routinely engaged in practical situations involving information literacy (Smith, 2007). These “one-shot” teaching arrangements are typically organized piecemeal, vary from year to year, and are primarily scheduled around the needs of the faculty member. It can be difficult for librarians to maximize their impact on students when so many aspects are beyond librarians’ control. A key benefit of embedding partnerships is that the librarian can have a greater voice in how their efforts are utilized.

Even in innovative courses, there is room for greater librarian involvement. Take, for instance, a well-organized research-based course in Introductory Environmental Science at Colby College. Students work on comparative case study-based research projects toward four goals: 1) teaching students the research process and methodologies; 2) enhancing their internet and library research skills; 3) mentoring them through a hands-on research project; and 4) interpreting and presenting their results (Firmage *et al.*, 2007, p. 89). Their emphasis on library skills is laudable; however, goal (2) is based on one lecture delivered by a librarian after which students were “encouraged to seek further help . . . outside of class from the reference librarians” (2007, p. 94). While Firmage *et al.* are correct that students “will benefit from this early introduction to the library system throughout their time at Colby;” there is an implicit message that library skills are crucial on paper, but are an add-on in practice, and that one visit from a librarian is sufficient for students to “get” information literacy (2007, p. 94). While library skills appear among the chief goals of the course, the librarian is far from embedded into the fabric of it.

Librarians are increasingly dissatisfied with this one-shot model of instruction (Mery *et al.*, 2012). As an alternative to business-as-usual, embedding librarians into seminars held in the library as well as the classroom, would afford librarians the opportunity to impart information literacy to students at a far deeper level than what might be accomplished during a quick rundown of the library’s resources. There are multiple, compounding lessons on the ethical consequences of plagiarism or the benefits and pitfalls of using “crowd-sourced” information hosted by sites like Wikipedia that can be considered. After all, information literacy skills lace together nearly any lesson in the natural and social sciences, especially with regard to student research opportunities. The literature documents instances of librarians entering the classroom to

teach entire credit courses themselves (Li, 2012) , assisting subject faculty with assignment design (Kirkwood and Evans, 2012; Kobzina, 2010), and providing detailed, discipline-specific library instruction (Ferrer-Vinent and Carello, 2011).

There are those who advocate embedding student research into the college curriculum (Husic and Elgren, 2003; Hagel *et al.*, 2012). To Smith, this implies that “efforts to teach and develop information skills should [also] be integrated throughout undergraduate programs” (2007, p. 137). A good model exists at the Massachusetts Institute of Technology, in their Terrascope first-year experience. Students are split into teams and “a librarian [is] assigned to each team by a member of the MIT libraries” where librarians are reportedly seen as “invaluable in identifying and locating resources that will be useful to the team” (Epstein *et al.*, 2007, p. 71). Additionally,

in the class [librarians] also play a strong role in helping students evaluate the text that will ultimately appear in their ... [projects, and] ... [l]ibrarians review these drafts and identify problems in sourcing; in some cases they also review some of the source material themselves to ensure that students have interpreted it accurately (Epstein *et al.*, 2007, p. 71).

Undergraduate Research Experiences (UREs)

Academic librarians are no strangers to helping undergraduates do research. After all, librarians are the curators and guides to resources researchers need. However, since this help has usually fallen under the general rubric of “reference service,” it is difficult to quantify and take credit for. In order to better understand how librarians can become more clearly involved in

undergraduate research, it is worth focusing on the technical usage of the terms “undergraduate research” (UR) and “undergraduate research experience” (URE). The Council on Undergraduate Research (CUR), defines UR as “[a]n inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline” (“About CUR”, n.d.). Thus, UREs involve students, usually with faculty guidance, engaging in their own original research—experiments, archival research, mathematical investigations, etc.—with potentially publishable results. In this literature, “mentored research” is treated as synonymous with UR and UREs. Thus, UR is to be distinguished from the library research that undergraduate students usually do for term papers and other class assignments.

Literature suggests that a sense of belonging (i.e., community) improves undergraduate student retention. Tinto found that an "individual's integration into the academic and social systems of the college ... most directly relates to his continuance in that college" (1975, p. 96). Regarding commuter college students, Johnson found that staff- and faculty-student interactions, which create a sense of community, are an important factor for student retention, particularly among female students (1997). Decades ago, Terenzini and Pascarella found that male and female students who reported working with faculty outside of class on intellectual topics were more likely to stay in school, and this was especially the case among first-year students, even those with symptoms that usually predict early withdrawal (1980). On balance, however, Light reminds readers that while learning outside of the classroom is vital, students who grow the most academically also tend to be the most involved in academic work with faculty (2001). For these reasons and others, Kuh and Gonyea encourage librarians to “redouble their efforts” to collaborate with faculty, student affairs professionals, and other staff to promote information literacy inside and outside of the classroom in a range of different activities (2003, p. 270).

Relatively less is known about librarian involvement in UREs (Stamatoplos, 2009). Still, at the University of Guelph, a science librarian has embedded in a first-year symposium for science majors, which includes the production of an electronic research journal that the students write and peer review for, in order for them to gain firsthand understanding of the scholarly communication process (Pritchard, 2010). Georgia State University has experienced an increase in librarian consultations outside the lab and positive feedback from faculty and students as a result after librarians were embedded in a chemistry lab course (Tomaszewski, 2011). At Indiana University-Purdue University Indianapolis (IUPUI), librarians collaborate with many of IUPUI's undergraduate research programs (Stamatoplos, 2009). Stamatoplos reports that working with students in UREs is more like working with junior faculty than it is working with other undergraduates, and importantly, discusses ways that librarians modify their approach to service in order to create the time necessary to serve URE students (2009).

Student Retention and Libraries

With enrollments beginning to dip in the United States, student retention is becoming a way to define success in higher education administration, and understandably so (L.G. Knapp *et al.*, 2012; Lederman, 2012). With diminishing resources, it makes sense for administrators to focus on increasing the rate of student persistence (Tinto, 2006). However, without students of “their own” to “retain,” is there a way for libraries to receive greater recognition for their role in the functioning of degree programs?

One explanation for why it is so difficult to link the services of libraries to the needs of colleges and universities regarding student retention is related to assessment. The culture of assessment in higher education has usually meant the increased use of measures to document the

direct effect of, for example, a learning intervention in a given course or to show how a particular configuration of skills coalesce at the program level to create a well-rounded undergraduate student. The broad shift toward greater accountability through the increased use of assessment tools has been a slow, sustained effort among institutions of higher education and the same is true for libraries (Moltz, 2009; Ndoye and Parker, 2010; Weiner, 2009). The problem for librarians is that rather than being fully integrated or embedded into the course and being involved with its design, objectives, and content, they are often in the position of having to wait for patrons to contact them before they can add value. This makes it difficult for librarians to claim a positive, tangible influence on student retention efforts.

Retention is not an alien concept to librarians; it can be argued that the profession has been involved in efforts to retain students as library users since the birth of the World Wide Web. Librarians need only to reorient this mindset toward the more strategic goals of retaining students in the college or university.

Background research links libraries to student retention. Lindauer found that libraries' attempts to describe their impact on the goals of their colleges are often "not sufficiently strategic" (1998, p. 546). At the time, most of the literature was also internally focused. Since then, librarians may have learned to market libraries better, but there is still a tendency for librarians to focus on providing the best libraries possible, rather than aligning their services with institutional outcomes. Emmons and Wilkinson join Lindauer in the movement to find new ways of measuring success in libraries, namely, focusing on outcomes, rather than the traditional "input/output" measures such as the number of books in a collection, number of reference questions asked, and circulation statistics (2011). One might call these the "library being the library" measurements. The goal now is to explicitly link library resources and student retention.

Still, a number of studies use traditional statistics to link the library to retention. For example, a statistically significant connection has been shown between student retention and higher levels of book loans, library workstation logins, and other library logins (Haddow and Joseph, 2010). Grallo *et al.* adds that positive relationships have been shown between student retention, library expenditures, and course-integrated instruction (2012). The growing knowledge commons concept also shows promise to enhance retention efforts by helping to acculturate students to college-level study. It would be fair to tentatively conclude, therefore, that students who utilize library facilities or services tend to stay in college. However, there are also ways other than the existence of library facilities for libraries to positively affect retention.

The Association of College and Research Libraries, in its report, *The Value of Academic Libraries*, includes the recommendation to “link libraries to improved student retention and graduation rates” (Oakleaf and Association of College and Research Libraries, 2010, p. 13). Acknowledging the limited influence librarians may have on individual students, the report recommends integrating library services and resources to “high impact educational practices,” listing first-year seminars, learning communities, and undergraduate research among their examples of such practices (Kuh and Schneider, 2008; Oakleaf and Association of College and Research Libraries, 2010).

Benefits and Implications

The librarian who is embedded into the curriculum is a librarian who is connected with their patrons in a longer-term fashion than the traditional model of library reference service, which, it has been argued, is fading away (Shumaker and Makins, 2012; Shumaker, 2012) An embedded librarian in the classroom is aware of all of the work the students are engaging in, not

just a single assignment they are asked to help the students with. This link, then, between early, on-going engagement with librarians creates a direct link to the assessment of important measures of success such as retention. It is the opinion of the authors that teaching students detailed citation skills early on and then consistently following up on their citations should alone improve retention because fewer students should be expected to violate the academic codes of conduct regarding plagiarism. And if an embedded librarian is an involved partner in student research teams, the librarian can provide point-of-need service as research progresses, and raise questions while providing answers that their faculty colleagues might not anticipate (Shumaker, 2009).

Current research suggests that embedding librarians into academic activities also results in a more collaborative relationship between the library and broader campus community (Dewey, 2006). In effect, both parties benefit. Library services will improve and expand as librarians work to engage their campus communities more directly. Members of the campus community, with the aid of librarians, will also be able to improve the learning experiences they offer, and a broader recognition for the role of the library will emerge. While not yet a widespread phenomenon, librarians are being selectively and, on occasion, systematically, embedded in all manner of academic activities to enhance independent studies, internships, multi- or interdisciplinary grant writing and manuscript preparation, as well as undergraduate research and course development (Becker, 2010; J.A. Knapp *et al.*, 2012).

Expanding these opportunities for libraries and librarians provides a direct link to mission critical indicators of success, especially in institutions set on providing a student-centered curriculum; however, it may be a daunting prospect for librarians to retool their services and branch out into unfamiliar territory. Aside from continuing education for librarians, another

major concern may be where librarians will find the time to embed themselves. The literature suggests that librarians are already overworked and that library staffs, nationally, are shrinking (Davis, 2010; Stewart, 2010). Therefore, concerns from librarians about where they will find the time to expand their mission through embedded librarianship are valid and should be raised (J.A. Knapp *et al.*, 2012).

Getting out of the library and embedding can help librarians to better anchor themselves in the life of their institution. In a sluggish economy, it behooves people in any profession to: “be visible;” “be easy [to work with];” “be useful;” and “be ready” (Viscusi, 2008). Academic librarians can be considered vulnerable not only because of the current economy, but because higher education more broadly is undergoing many changes—witness Massive Open Online Courses (MOOCs), and concerns about the sustainability of the student loan industry. It is a particularly bad time for one’s usefulness to be in question. Librarians must be prepared to demonstrate that they are doing more than just being good at using the library. They must demonstrate that they are essential to their universities’ bottom line. Student retention by way of embedding in “high impact educational practices” such as UREs provides an avenue to demonstrate this impact.

Practical Advice for Getting Embedded

Discussing the benefits of embedded librarianship is one thing, but actually becoming embedded is something else entirely. What follows are some points to consider for those librarians seeking an embedded arrangement.

Librarians interested in getting embedded in a class or program will need to find a suitable faculty member to approach. Many librarians can use their existing faculty contacts to

propose an embedded arrangement—certainly having an agreeable colleague is helpful when trying out new methods in the classroom. Getting involved in campus committee work, social functions, and even presenting their own research in campus research talks and colloquia is an important way librarians can build relationships with faculty. Boice's *Advice for New Faculty Members* is an excellent title for advice that is relevant to new faculty members as well as librarians interested in working closely with them (2000). Librarians interested in embedding should be prepared for some rejection. Some faculty will simply not be convinced that such long-term involvement by a librarian will be that valuable, at least in the beginning. Starting small by offering to provide one or two presentations a semester can be a good way to get started.

Librarians also should decide in advance how much time they have to devote to an embedded relationship. Because faculty outside of the library may not understand the constraints on a librarian's time—and vice-versa—it is important to clearly agree to a time commitment, such as whether the librarian will attend specific class meetings or all of them, where they will be held, what will be expected of the librarian outside of class times, etc. Due to the time investment that can be involved with embedding in a classroom, librarians should ideally try to focus on “high-value” courses (i.e., courses with more achievement-oriented students such as honors courses, or specifically, undergraduate research experiences or lab groups) for maximum student impact. UREs are this type of program, and since they are a relatively new type of program at many places, there is less potential for the librarian to be viewed as imposing on an established program.

If interested in getting involved in a URE, librarians should seek out any kind of lab groups or classes available at their campuses. Undergraduate research exhibitions, or “research fairs,” can be a good place to make connections with students, faculty advisors, and any student

groups that focus on research. Undergraduate research exhibitions are frequently sponsored by an institution's "Office of Undergraduate Education," or related department. If no such exhibitions are currently being held, a library might consider sponsoring one itself as a way to highlight the library's interest in students' research. A practice that has helped at the Pennsylvania State University ("Penn State") is the offering of the University Libraries Information Literacy Award at the exhibition, where librarians can judge research posters based on their use of scholarly sources, and interview participants to judge their understanding of information literacy concepts. The savvy students and faculty participating will learn to consult with a librarian the next year, to be sure they are prepared to perform well. This can be an opening librarians can take advantage of to transition to a more permanent presence.

Ultimately there are no prescriptions for creating ideal embedded arrangements for librarians. However, thinking strategically about relationships and positioning the library as a problem-solver and a resource can go a long way toward easing the process.

Current Situation: The Integrative Social Sciences Research Lab

For the past five years, Penn State's Altoona campus has had an undergraduate research lab in the social sciences, run by Charles, a tenure-line psychologist, and Rowland, a tenure-line sociologist. For the past two years Knapp, a research librarian, has regularly attended the lab's weekly meetings and worked closely with students on several projects. Each semester, the authors are joined by 16–20 students who run research projects. Several of the projects are student driven from conception to report, and each semester three to four students act as project leaders, with the rest gathering data (other projects are led directly by the authors).

The current lab group meets once every week for a two-hour period. A reading is assigned for each week, often an article from an academic-targeted publication, such as the *Chronicle of Higher Education*, or academic blog posts. The first hour of class is generally a discussion of the week's article. Two examples of readings used are "Why Read Book Reviews?" and "On the Challenge of Becoming the Good College" (Wasserstrom, 2011; Guarasci, 2006). The readings help the students to understand the "big picture" of the academic enterprise and allow them a glimpse into the world of their professors. This glimpse allows the students to see their professors as more than just the people lecturing them from the front of a classroom. This "humanizing" effect benefits Knapp, the librarian, as well, by giving him a forum in which to comment on issues from a scholarly communications perspective, allowing students to see that a librarian is involved more deeply in the institution than just pointing out databases and finding library materials.

Knapp has contributed to the lab's overall curriculum by selecting readings for class discussions and doing class presentations, including topics such as "How Does Google Work?" and "How Wikipedia Works and What It Can Teach Us about Knowledge." Lessons such as these help students understand the importance of reading critically, and allow students to see the librarian as a scholar in her/his own right.

During the second hour, students report on the status of their group research projects, discussing the progress they have made since the previous week, what their goals are for the coming week, and what, if any, hurdles they encountered. Common hurdles involve locating prior scholarship on the same topic, refining measures, determining how to analyze and present data, and conforming to professional standards. The astute librarian will recognize that each of these practical problems requires engagement with the literature. Research projects over the past

five years have ranged from experimental studies of video games and violent behavior to conducting content analyses of documents pertaining to the institutional adoption of software technologies.

Outside of the lab classroom, the librarian has contributed to each of the research projects by working with students individually. One of the most important lessons that have been imparted is the importance of doing background research at the experimental design phase. Although students often want to start their experiments immediately, the librarian has been able to help them understand that the scholarly literature is full of accounts of similar experiments, complete with discussions of problems in their design, and how future researchers can avoid them. Engagement with the literature of their disciplines is an ongoing theme. Many lab students contact the librarian frequently for their other courses, since their familiarity with him from the lab gives them a better understanding of the concrete benefits he can offer.

In all, the lab has at least six class goals. First, expose lab students to the research methods used in multiple areas of the social sciences. Second, provide them with extensive research experience using specific methods on specific projects. Third, develop students so that they can lead their own research projects in the future. Fourth, prepare said students to make sensible future career decisions. Fifth, critically discuss with students professional development issues not normally covered in topical classes. Sixth, prepare all projects to compete in undergraduate research fairs and prepare as many projects as possible for presentation at professional conferences.

Lab students have three course credit options for entrance into the lab. All students in the lab are there in exchange for course credit. No students are paid for their work in the lab; however, work-study students and paid undergraduate assistants are utilized by the faculty

members running the lab, but only to support lab activities (i.e., events rather than research) or the faculty's research line (i.e., rather than the projects generated by the students). There are three "standard" ways to earn credit through the lab, other arrangements may be considered on a case-by-case basis:

- *Lab Member*: At the novice level, students can be a "Lab Member" for one credit of low-level credit (in our case, 200-level credit where 400-level credit is the highest level reserved typically for juniors and seniors). On average, lab students at this level are expected to contribute three hours of research effort per week for 16 weeks. First-year and sophomore students interested in gaining general exposure to the workings of a research lab may enroll in one credit of psychology or sociology credit. Students receiving one credit are expected to attend lab meetings for two hours on Friday morning. They are to complete the assigned weekly readings, submit the required summary (see below), show up prepared to discuss, and be active contributors to discussions. In addition, they are expected to help as needed with studies, for example, coding, entering data, participating in pilot work, etc. This, and preparation for lab meetings, can be expected to average one hour per week.
- *Research Team Member*: At the intermediate level, students can be a "Research Team Member" for three credits of low-level credit (200-level credit). On average, eight to nine hours of research effort per week for 16 weeks. Students of any level interested in gaining significant experience with a particular research project may enroll in three credits of psychology or sociology. In addition to all expectations listed above, students receiving three credits are expected to run subjects or analyze archival data for three additional

hours per week, which does not include set-up or take-down of experiments, and does not include participating in occasional data coding or data entry following Friday meetings.

- *Research Team Leader*. At the advanced level, students can be a “Research Team Leader” for 6 credits of upper-level credit (400-level credit). On average, 15–18 hours of research effort per week for 16 weeks. Seniors or advanced juniors interested in leading their own projects may enroll for six credits of psychology or sociology. In addition to all expectations listed above, students receiving six credits are expected to be the lead on a study. Students who are team leaders will be responsible for organizing the activities of their team and preparing weekly reports on team progress. They will be expected to give at least one in-lab presentation per semester, which requires a summary prepared in advance (see below). In addition, they will be in charge of producing a major report on the study they lead. All major reports are expected to be in the form of a thesis, of quality and style appropriate for submission to a journal. Reports represent not only work managing the research effort but also significant efforts reviewing the relevant research literatures.

With a librarian on board, the quality of student projects has improved. A crucial reason Knapp has become so integral to the lab is that the projects are student-driven. Many professors simply have students do the next step of their own research, and thus believe themselves fully capable of guiding students to all needed resources and through all issues of disciplinary practice. But when students are driving the research agenda, no professor feels immediately confident enough to address the many research topics involved, making the librarian a valuable asset.¹ The librarian teaches the students to become independent learners: learning how to recognize when they need information; how to access it; and when to incorporate it into their own knowledge

(Association of College & Research Libraries, 2000). Continuous interaction between students and the library becomes essential, and everything is streamlined by bringing the knowledge of the library to them in the classroom.

In addition, Knapp's presence in the classroom has led to the creation of new types of projects that would not have been considered previously. One example is a group of four students working to create an archive of historical materials related to the history of African Americans in Pennsylvania's central valley (from the extensive personal collection of a staff member). Knapp has used his expertise in information organization to help the students think about important aspects of how to organize the collection and also arranged for a visit to the Penn State University Special Collections Library at the University Park campus and a presentation by the head of the collections so that the students could see firsthand the process that goes into organizing them. Knapp has also helped with a student's project of sifting through archival materials dealing with the creation of university departments and academic programs in response to student protests in the 1960s. Worth noting, the authors agree that when this student graduates, he will graduate as one of the library's students every bit as much as he is a major in his chosen field of study.

Along the way, the influence of lab experience on the average lab student has been informally analyzed. Although students in the lab have been personally selected, a "lab effect" has been noted. The student, upon entering the lab, begins to advance professionally in the lab seminar as well as their other courses. During exit interviews with past lab students, they uniformly state that once they enter the lab they get the feeling that they are part of a community of advanced students and that they begin to feel as though they represent the group in their other courses. Several students identified as having untapped potential increased their grade point

average by over a point (typically from the mid-C to mid-B range) within a semester. Several students who would have barely scraped by in their previous trajectories have entered research, and are now in graduate programs. However, while some lab students are struggling to improve themselves academically, students in danger of failing out of college are rarely encountered, i.e., the lab seminar is not a retention machine for at-risk students. Still, students' improvement is often remarkable, and has been noticed by administrators. Awards, conference presentations, honor societies, names on papers, and campus-relevant research reports all make it clear that the lab is providing value to the college, and Knapp is seen as integral part of student advancement and excellence on campus.

The next step is to apply the lessons learned from mentoring students through a social science research seminar to benefitting first-year students, eventually on a large scale. A first-year seminar is being designed to test the usefulness of an embedded librarian in developing social science research capabilities among first-year students. The key benefit is that students will learn to do research by actually doing research. Even more novel in these efforts is that the librarian will be involved in the course design itself from conception to implementation to assessment.

Proposed: First-Year Research Seminar with Librarian

Since it has been shown that an important strategy for positively affecting student retention is having greater student engagement with faculty and staff, and since the authors have experienced success with upper-level students in the aforementioned Social Science Research Lab, the authors have proposed a first-year seminar incorporating an embedded librarian.

The impact of undergraduate research and embedded librarianship can be further leveraged if students are exposed to them earlier in their academic careers, preferably during their first year (Nelson *et al.*, 2012; Porter and Swing, 2006; Terenzini and Pascarella, 1980). The earlier the intervention, the greater the impact will be on retention and long-term grade point average. While the authors' experience is centered in the social sciences and in training social science students, there is no reason to believe that retention benefits would not also translate to the natural sciences, engineering, and the humanities. Regardless of the discipline, this will improve the visibility of librarians as a crucial component in the educational (and financial) mission of the college. The authors also intend to do this in a way that will have a clearly documentable outcome, demonstrating the benefits of their work in terms that college administrations understand and reward.

It is recognized that many liberal arts colleges have robust research education systems already, and that these colleges, as well as many top research schools, have students who arrive "research ready." The situation at Penn State Altoona is more typical of the vast majority of state schools and community colleges. Students there are middle-range, many are first generation, and they generally do not have a robust understanding of how college will be different than high school. The college offers some optional first-year seminars, but they are not common. The authors are creating such a course that will include students who intend to be social science majors. To document the effects of this course, a matched control group of first-year students from the same cohort (a group of students with similar high-school GPA, SAT scores, gender, etc.) will be created. Both groups of students will be assessed at the beginning and end of their first semester, and at various other points during their time as students. This will allow documentation of short-term and long-term effects of the curriculum to be implemented. The

goal of the course will be to provide an overview of the research process, including having students perform research of their own (on a modest scale). This will have a heavy “information literacy” component that will be in the context of project-centered work, rather than in the abstract.

Another crucial goal is to make the basic parts of the seminar portable. While not every campus has a first-year seminar *per se*, the lessons from this class need to be easily transportable into first-year and sophomore level classes at other locations. A plan for how this will work follows.

Framework of the Curriculum:

The seminar will follow a 16-week semester schedule, with a prescribed curriculum. A core component will be a series of Montessori-style, learn-by-doing exercises. Initially one game will be created for each week, and this portfolio will be expanded in future years to a total of at least 32 games. On “game days” students will have a short reading and then break into small groups to work through exercises that demonstrate the process of science in action. Examples of games and the skills they will develop include:

Example 1: The first “science game” will be for students to understand how research builds from previous research, and not from random or merely interesting questions. The implicit message will also be to see how research is seldom the work of a single genius scientist, and instead how the slow scientific enterprise of discovery and subsequent refinement develops over years, if not decades, resulting from the work of numerous researchers from across the nation or around the world. The game will consist of placing ten “scrubbed” article abstracts—meaning they have no title, author, or year of publication—in order of publication. Of course, earlier

papers will be theoretical or programmatic in form, while later papers show robust results, perhaps a replication, or a review. In the interim, a series of papers building on one another will be observed and ordered by students. This game will require students to read the abstracts analytically, reread them many times, and develop techniques to conceptualize how to order the abstracts according to the contours of discipline-level research processes—which is a crucial reason to have a librarian available from concept to implementation. Students will learn, indirectly, how to engage ongoing research trajectories involving multiple scientists.

Example 2: Students are given examples of three studies in the literature, with sufficient details to determine how the data was collected and how it was analyzed. Students will then be presented with a “next-step” experiment, and will be asked to determine (through comparison with the previous examples) what type of analysis will be needed. Through this, students will learn to appreciate that different statistical abilities are required for different types of projects, even though they cannot yet be expected to have any real understanding of how those statistics work. That is, there will be no explicit effort to teach them statistics, but instead to lay the foundation for them to understand why statistics will be required as part of their curriculum.

Example 3: Students will be presented with several experiments in an area, spread across multiple venues, and will need to determine the differences between the venues in which the various studies were published. This will include noting stylistic differences in how experiments are framed, as well as the types of studies in various venues. They will also be presented with articles about the same experiments that appear in newspapers and popular magazines and websites to show how very important information can often get lost in the jump to a popular publication. This will increase their understanding of how scholarly information gets distributed, and show why literature searches using library research tools necessarily take time and creativity.

All examples will be built out of real research literatures, so that students are also learning factual results of social sciences work. Knapp will be crucial in this process by helping to evaluate potential real-world examples that will be most useful in facilitating the information literacy component of the games. He will also help in designing games to accomplish other information literacy goals. After 16 weeks of exposure to these ideas, it is expected that students will have made significant advances in both their ability to utilize the informational resources of the university in their student work, and to articulate their importance in other contexts (such as faculty research).

On non-game days, students will use the skills they have developed to make progress towards completing a small group-implemented research project. Tasks on these days will include doing a literature review, explaining how their project logically builds on that past work, determining how to analyze their data (obviously the instructor will need to perform any statistics, but the students should be able to identify similar designs in the literature, and determine what types of statistics those publications used). Knapp will be present in the classroom to aid them in these activities.

The freshman seminar concept, as envisioned here, is unique. Students would enroll in the seminar for three low-level credits, as first-year experiences and freshman symposia are usually offered in the United States; however, these students would also attend weekly lab meetings, where they would participate at the novice level (i.e., as a “Lab Member”) for one additional low-level credit.

Assessment

At the beginning of the semester, students in the first-year seminar will undergo assessment in order to establish a baseline (pre-test) score for various assessment measures. At the end of the semester, students will undergo assessment in order to establish a comparison between their baseline (pre-test) score and their subsequent (post-test) score; this will help determine subsequent growth or decline in score over the first semester for various assessment measures.

In addition to student grade point average and progress toward major, which will also be recorded, students will be assessed using the following measures during pre-testing and post-testing.

1. *Skill Outcomes:*

- Information Literacy Assessment
- Evaluation of Primary and Secondary Research Materials Inventory
- Evaluation of Scientific Evidence Assessment
- Synthesis of Research Findings Assessment
- Critical Thinking Assessment
- Identification of Gaps in Knowledge Assessment

2. *Social Outcomes:*

- Ethical Behavior in Institutional Settings Assessment
- Ethical Behavior in Science Assessment
- Identification of Ethical Issues Assessment
- Value of Equity and Diversity Inventory
- Self-Respect Inventory

3. *Knowledge Outcomes:*

- History of Ethical Issues in the Social Sciences Inventory
- Process of Scientific Communication Inventory
- Working Effectively in Groups Inventory
- Pathways to Careers in Science Inventory

Assessment is a crucial component to justifying continuation of the curriculum at the authors' college, and creating a framework of information to facilitate adoption at others. While deeply interested in all these variables, the authors expect their administration (and others') will be most interested in those variables on which they themselves are judged (both within the institution, by the public, and potentially by accreditation bodies). Such variables include overall retention rates, years-to-completion, overall grade point average, disciplinary infractions (e.g. rate of plagiarism violations), and the number of repeated courses students must take. Each of these creates expenses the college must absorb, and many are publicized in public reports that affect funding from outside entities (including state governments, foundations, and independent donors).

Next Steps

Over the next three years, a portable first-year seminar organized around "science games" for enhancing the student's capacity for information literacy will be developed, pilot tested, and fully implemented. Upon local stabilization of the program, the next step will be to expand its reach to other colleges and universities. Expressions of interest in implementing the proposed program once it is complete are welcome. This could include interest from people who might try to implement the entire framework of dedicated seminars on their campuses, or people who

simply wanted to implement a series of the proposed “games” into their preexisting courses. Building sufficient interest to convince the appropriate administrators can take time, especially when trying to justify the embedded librarian component of the curriculum, and the authors will help interested parties start creating the context in which such collaborations will be possible.

Conclusion

Undergraduate research experiences and student lab cohorts are a potentially rich area to be tapped for librarians and their faculty colleagues to positively affect student retention efforts in higher education. Through examples of prior research regarding student retention, it has been shown that librarians can have a positive effect on student retention, and can play a pivotal role in positively affecting the undergraduate student experience overall. Academic librarians will need to take a more outward, proactive turn in order to do this, extending themselves into longer-term classroom and lab experiences.

The goal of further research in this area should be to quantify the effect of embedded librarianship on students by using student data to make a strong connection to retention. Further research could also address possible ways for librarians to shift their time commitments to better accommodate the increased time spent embedded in course or lab work, e.g., seeing if there are lower-impact time commitments that can be reduced or eliminated. Additionally, some research into practical ways for librarians to get embedded into undergraduate research experiences would be helpful as well.

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Notes

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1. Rowland and Charles have acknowledged learning better bibliographic research skills themselves from working with Knapp.