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# Learning, unlearning and relearning – knowledge life cycles in library and information science education

Denise A.D. Bedford
*School of Library and Information Science, Information Architecture and Knowledge Management, Kent State University, P.O. Box 5190, 314 University Library, Kent, OH 44242-0001, USA*
*E-mail: dbedfor3@kent.edu*

The knowledge life cycle is applied to two core capabilities of library and information science (LIS) education – teaching, and research and development. The knowledge claim validation, invalidation and integration steps of the knowledge life cycle are translated to learning, unlearning and relearning processes. Mixed methods are used to determine the extent and nature of learning, unlearning and relearning among academic faculty in graduate level library and information science programs. Mixed methods include (1) targeted interviews, (2) manual review of curriculum scope and coverage at seven universities, (3) semantic analysis of the content of 1,711 course syllabi, and (4) machine based analysis of learning, unlearning and relearning semantic markers in 432 journal articles drawn from twelve peer-reviewed journals. The research results provide a foundation for an open and national survey of LIS faculty in 2015. Research results suggest that there is evidence of learning, relearning and unlearning in teaching methods, but only evidence of learning in curriculum and course development, and research. Unlearning practices appear to be scarce in the field. This has implications for the disciplines ability to generate new knowledge and remain competitive in the knowledge economy.

Keywords: Faculty learning, unlearning relearning LIS curriculum LIS course syllabi knowledge management semantic methods

## 1. Introduction

Traditionally, academia has been the primary creator of knew knowledge, and a trusted source in the validation and invalidation of existing or new knowledge. We trust universities to advise us when knowledge is trustworthy, when it has been rigorously tested and when the quality of knowledge is uncertain. In the 21$^{st}$ century knowledge economy, this is a critical function. Knowledge – validated, trustworthy, reliable – is the source of growth in a knowledge economy. Just as land, equipment and financial capital were the engines of growth in earlier economies, knowledge is what drives the knowledge economy.

Universities face a challenge in the 21$^{st}$ century knowledge economy. In 2015, we have four of the most highly educated generations in history alive and working together in the workplace. Knowledge organizations that make up the knowledge economy are now producing new knowledge at a rate equal to academia. As Fazlagic [1] suggests, today's universities are slow to innovate and may lag behind other kinds of organizations in generating new knowledge and ideas. Academia may be a source

of education and learning for students, but it must also generate new knowledge at a rate equal to or greater than that of external organizations. Those academic institutions that are able to do this will remain competitive in the knowledge economy. Those that do not will find it increasingly difficult to retain their position as sources of knowledge and ideas. The World Bank Group, the Urban Institute, the McKinsey Global Institute, Apple, Intel Corporation, Xerox Corporation, IDEO, Brookings Institution, Bristol-Myers Squibb, Roche, Marathon Oil, Kraft Foods and Hershey are only a few examples of organizations and companies that support internal research and knowledge creation. It is imperative that academic institutions continue to retain their positions as neutral, trusted and accessible knowledge organizations to ensure that everyone in a knowledge society has access to ideas and knowledge.

Academic institutions are a primary source of knowledge transfer, absorption and integration for students. We expect students to gain knowledge through their academic experiences. The major production of knowledge in academia, though, must come from faculty. Faculty teach, do research and development, advise students and organizations, convene communities to address challenges and to spread knowledge, and advocate for important issues. We expect faculty to be at the center of any knowledge generation activities.

We want to understand more about faculty knowledge production in academia. How can we determine whether faculty are producing new ideas and knowledge? Defining a research framework to explore this question is not trivial. To begin, we must have a model of knowledge generation. And, this model must be applied to faculty academic roles and responsibilities. We begin by looking to the literature of knowledge sciences and knowledge management for good models and methods. We leverage two models that are core to this discipline, specifically McElroy's knowledge life cycle (KLC) [2,3,4,5,16]. We leverage and adapt these models to explore whether, and if so, how knowledge is being generated by academic faculty.

This special issue focuses on the use of knowledge management methods in library and information science education. This research focuses on knowledge production by LIS faculty. This is an important discipline for the knowledge economy. Every knowledge organization needs to be aware of and manage its information. Organizations hire library and information science graduates to establish good information management practices and to design effective information services. As an economic sector, information sciences has a vibrant and thriving private and public sector base. What stimulates this economic sector is the new knowledge and ideas that are injected into the economy each year in the form of information products and services. If as some have suggested [34] the library and information sciences discipline is to remain a source of learning, research, advice, and advocacy, it must generate new knowledge and ideas at least as rigorously as non-academic institutions. For these reasons, this academic discipline provides a good focus for this exploratory research.

### *1.1. Knowledge management models and methods*

The knowledge management literature is rich in models and methods that speak to the process of knowledge creation [17]. To support this exploratory research, we

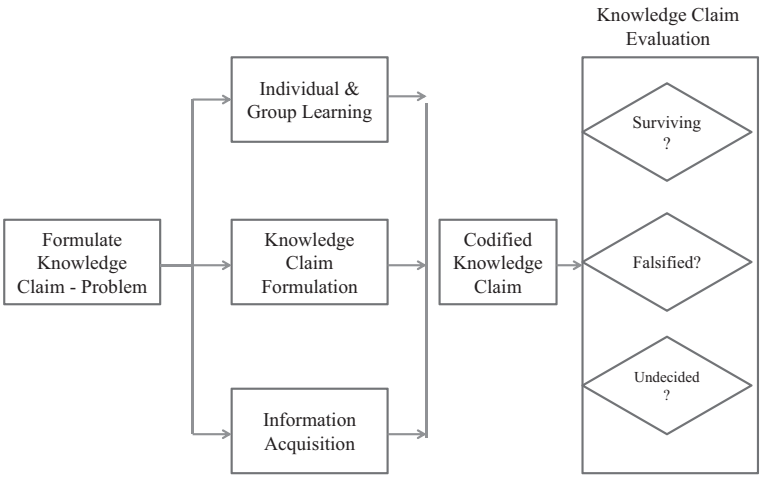


Fig. 1. McElroy's knowledge life cycle model (http://www.macroinnovation.com/images/KnlgLifeCycle.pdf).

leverage McElroy's Knowledge Life Cycle (KLC) [2] and the models of learning organizations referenced earlier.

McElroy's KLC model (Fig. 1) is a good representation of the conditions under which new knowledge is created, how existing knowledge is challenged, how old or invalid knowledge is discarded or invalidated, and how reformed knowledge is added to the stock of knowledge. The KLC is different from an information management life cycle which focuses on the life cycle of the encoded object or a tangible information product. McElroy's model begins with the assumption that knowledge gaps, learning and information acquisition are an importanttriggers for creating new knowledge. When a knowledge gap surfaces, we are motivated to create or acquire knowledge to fill the gap. McElroy suggests that individual and group learning and information acquisition help us to surface and fill knowledge gaps. The process of filling those knowledge gaps begins with a knowledge claim which is then rigorously tested. New ideas and knowledge claims are either validated, invalidated or they are noted as preliminary and uncertain. The outcome of the knowledge claim process is an integration of new knowledge into the body of knowledge of the discipline. McElroy's characterization of learning aligns with that of thought leaders [4,5,6]. McElroy's characterization of information acquisition aligns with but expands upon the ideas of Nonaka and Takeuchi [18].

The heart of McElroy's model is the knowledge claim validation process. The validation of new ideas and knowledge is a process by which an organization – or in this case a discipline – introduces new knowledge claims to its operating environment and retires old ones. We find close parallels between the knowledge claim formulation, validation, invalidation and uncertainty claims and the process of learning, unlearning and relearning. Argyris and Schon [4] define organizational learning as the

detection and correction of errors. Schein [5] tells us that learning organizations routinely unlearn previous beliefs, are open to new ideas, and relearn new assumptions and behaviors. In essence, the literature on learning describes three critical phases that align with McElroy's knowledge validation process. These include learning, unlearning and relearning. We draw characterizations of learning, unlearning and relearning from this literature in order to develop a semantic profile of knowledge generation activities of academic faculty. For our exploratory research, learning is important but unlearning and relearning among academic faculty are equally important to generating new knowledge and ideas to keep pace with the broader industry. In order to develop a semantic model of these three processes, we need to draw from the peer-reviewed literature.

The peer reviewed literature highlights the importance of unlearning for abandoning outdated, misleading, inefficient and useless knowledge [9,20,21]. Unlearning is key to changing rigid beliefs, standards, values and routines [11,15,22,23,24,25,26].

Organizations or in this case disciplines can only learn, unlearn and relearn through individuals [19,27]. Individual unlearning is the process of substituting new Behaviours, ideas and actions for previous ones [10,28,29] claimed that individual unlearning referred to the capacity of individuals to reflect on their performance in order to identify and promote actions that resulted in improved performance. Nonaka and Takeuchi [18] pointed out that creative chaos can generate pressure to motivate members of the organisation to carry out individual unlearning and promote change. When individuals identify outdated knowledge or routines, they will eliminate them through individual unlearning.

Tsang and Zahra [14] identified 34 definitions of organizational unlearning in the literature and observed that all refer explicitly to a process of getting rid of certain things from an organization. Tsang noted that fourteen definitions placed a value judgment on the utility of the discarded items by describing them as obsolete, misleading, redundant, or unsuccessful – aligning with McElroy's knowledge invalidation phase. Ten of the definitions Tsang discovered highlight the importance of discarding of old ideas or routines for the purpose of making room for new ones. According to Tsang, unlearning is a gradual, continuous process that occurs more or less simultaneously with learning. When old routines are replaced by new ones, they are gradually removed from memory. Tsang also notes that while there are many casual references to unlearning, there have been few in-depth analyses of unlearning. Tsang emphasizes that organizational learning and unlearning describe two distinct types of change processes – acquisition of new ideas and discarding of existing ideas. While these processes are distinct, learning and unlearning may occur simultaneously. And, new learning may take place without old knowledge being unlearned. We can learn new things without discarding old knowledge. Ideally, this should produce knowledge gaps where there are conflicts. And organizational unlearning may occur without new or relearning. A vacuum may be created. Again this situation should produce a knowledge gap.

Cegarra-Navarro and Moya [21] suggest that individual unlearning can be divided into three phases that are closely aligned with McElroy's KLC. Specifically, organisational unlearning first begins with the identification of a knowledge gap or outdated knowledge. When individuals identify gaps or knowledge that doesn't fit a context or a current environment, they are open to changing their understanding and cognitive structures. This results in individual unlearning.

Zhao Lu and Wang [14] suggest that the acquisition of knowledge and eliminating outdated and useless knowledge are the keys for organisations to achieve the dynamic knowledge management. But the unlearning process of knowledge was still lack of sufficient attentions. Organisational unlearning is the dynamic process in which an organisation identifies and gets rid of useless and obsolete knowledge and routines, which hinder the acquisition and creation of new knowledge [30], (Cohen and Levinthal, 1990; Cegarra-Navarro and Moya, 2005). With the changes in the environment – in this case the shift from an industrial to a knowledge economy – we expect previously acquired knowledge to become obsolete and to lose value. Outdated and invalid knowledge can prevent the creation and flow of new knowledge so that individuals and organisations have no incentives for updating their knowledge to remain competitive [31,32]. Outdated or invalidated knowledge will become part of the culture and can significantly inhibit any incentives to create or share new knowledge. Unlearning or discarding outdated knowledge, routines and beliefs incentivizes organisations to create, learn and acquire new ideas.

Azmi [8] suggested that organisational relearning was a continuous process of organisational renewal, where traditional and outdated systems were replenished with life and vigor. Organisational relearning facilitated organisations to build new competitiveness [19]. Organizational relearning is achieved by individuals. Individuals initiate relearning for their own interests when environment changes, such as promotion or salary. Through the evaluation and acquisition of new knowledge, individuals change their knowledge structures and enhance the ability to solve problems. The characterization of relearning aligns with McElroy's KLC. The final step in McElroy's model is knowledge integration. This process includes all knowledge transmission, teaching, knowledge sharing, and any other social activities that communicate either an understanding of previously produced organizational knowledge to knowledge workers, or the knowledge that certain sets of knowledge claims have been tested and that they and information about their validity strength is available in the organizational knowledge base, or some degree of understanding between these alternatives. In other words, McElroy's knowledge validation and integration model provides a good framework for us to use in exploring the production of new ideas and knowledge.

Pratt and Barnett [33] suggested that organisational relearning is an adaptive process in which new knowledge structures replaced the outdated ones and in which routines were changed. Individual relearning consists of the acquisition of new knowledge, a change of knowledge structures and the establishment of new routines. Inflows of new knowledge inevitably change the existing knowledge structures of individuals and gradually form new effective ideas and practices which can contribute

Table 1
Semantic representation of knowledge validation cycle

| McElroy knowledge life cycle | Learning organizations |
|---|---|
| Knowledge Claim Formulation | Learning |
| Knowledge Claim Invalidation | Unlearning |
| Knowledge Claim Validation | Relearning |
| Knowledge Claim Uncertainty | Unlearning, relearning |

to individuals'improvement of their situation. The knowledge that individuals acquire through individual relearning is tacit knowledge, which must be transformed to explicit knowledge to benefit the organization or the discipline. Relearning in the learning literature involves knowledge transformation – the process of integration into the body of knowledge. In the process of knowledge utilization, groups gradually establish new routines to help them quickly adapt to changing environment. The establishment of new routines in the groups is a symbol of the achievement of group relearning.

We look to these two models from the knowledge sciences literature as we develop a semantic representation of knowledge production. The purpose of developing a semantic representation is to test for evidence of the production of new knowledge by library and information science academic faculty.

Where we see all four of three activities – learning, unlearning and relearning – in a discipline, we can assume new knowledge and ideas are being generated. We know from our review of the literature on learning organizations and the knowledge sciences models that all three are important to sustaining a healthy, relevant, vibrant academic discipline. Where unlearning is missing, we may simply be adding new learning to the stock of knowledge but never purging or putting aside old or outdated knowledge. Where unlearning takes place without relearning, we may be creating new gaps without filling them. Disciplines that do not look for and expose knowledge gaps risk becoming outdated and obsolete as a discipline.

### *1.2. Research context – library and information science faculty*

The research context consists of library and information science professionals who serve as academic faculty. Before we can apply our research model we need to set these two contexts. According to thought leaders in the field [34,35,36] information science is the study of the gathering, organizing, storing, retrieving, and dissemination of information. As Bates points out, information science examines the social, cultural, economic, historical, legal, and political contexts in which information systems are employed, both to inform the design of such systems and to understand their impact on individuals, social groups, and institutions. Bates emphasizes the interdisciplinary nature of the field, its use of multiple methodologies, and its relationship to such traditional disciplines as computer science, cognitive psychology, social science, cultural studies, and history. According to Borko:

> "Information science is that discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. It is concerned with that body of knowledge relating to the origination, collection, organization, storage, retrieval, interpretation, transmission, transformation, and utilization of information.It has both a pure science component, which inquires into the subject without regard to its application, and an applied science component, which develops services and products [35, p. 3]".

We focus on three categories of schools and colleges that support this broad and interdisciplinary field. We focus on faculty who are associated with schools devoted to library science, to library and information science, and to those school that focus on information science ("I" Schools).

The peer-reviewed literature provides examples of the application of knowledge management methods in academic institutions [37,38,39,40,41,42,43,44,45,46,47, 48]. Williams [49] and Warhurst [50] have suggested that intellectual capital – faculty as the primary source of knowledge – is a university's most valuable and strategic capital asset. As the university's primary source of intellectual capital, it is imperative that faculty continually learn, unlearn and relearn.

Faculty have many roles and responsibilities within the university. How do we identify those roles that are central to the mission of the university? We will leverage another common knowledge management method – business capability modeling – to define the core roles and responsibilities of faculty [51]. We use business capability modeling to represent what an organization does to perform or produce something of value to the itsstakeholders. An organization's full repertoire of business capabilities takes the form of a Business on a Page (BOAP). A Business on a Page defines all of an organization's capabilities and organizes them into three categories, including (1) strategic capabilities; (2) operational or core capabilities; and (3) enabling capabilities. Strategic capabilities are those dedicated to setting the future direction and driving the organization. We developed a BOAP model of a university in order to better understand what academic faculty do (Figure x). Enabling capabilities are those which support the day to day functioning of the organization. It is core or operational capabilities that distinguish one organization from another. Operational or core capabilities are those that define the essential business of the organization. Figure 2 represents the full set of business capabilities for a typical university. The university model has five high level operational capability areas including: (1) Teaching; (2) Research and Development; (3) Advising; (4) Advocacy; and (5) Convening.

While faculty are involved in all five of these business capabilities, Teaching and Research-Development are the most important for the creation of new knowledge in a discipline. This research examines the learning, unlearning and relearning practices in faculty teaching and faculty research and development.

### *1.3. Exploratory research questions*

This research projectposes and explores answers to two simple questions.

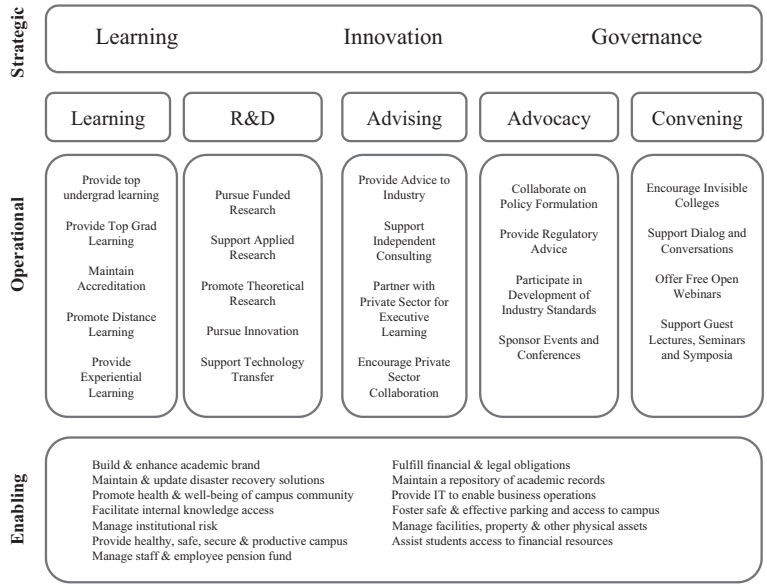


Fig. 2. University represented as a business on a page.

- What is the nature of faculty learning, unlearning and relearning in library and information science teaching?
- What is the nature of learning, unlearning and relearning in the research undertaken by library and information science faculty?

The answers to these questions provide a preliminary view of learning, unlearning and relearning in LIS academic programs. The intention is to use what we learn to identify ways in which to enhance the role of LIS faculty in the broader knowledge economy, specifically in the information services sector of that economy.

## 2. Research models and methods

This research takes a mixed methods. Approach to exploring the nature of learning, unlearning and relearning in faculty teaching and research. Mixed methods include targeted interviews, structured examination of content, machine based semantic analyses, and survey design and implementation. The research design was comprised of four stages (Fig. 3).

### *2.1. Stage 1. Targeted interviews with LIS faculty*

Stage 1 involved targeted interviews with seven faculty members. All faculty members interviewed were in tenured or tenure-track positions, and all engaged in

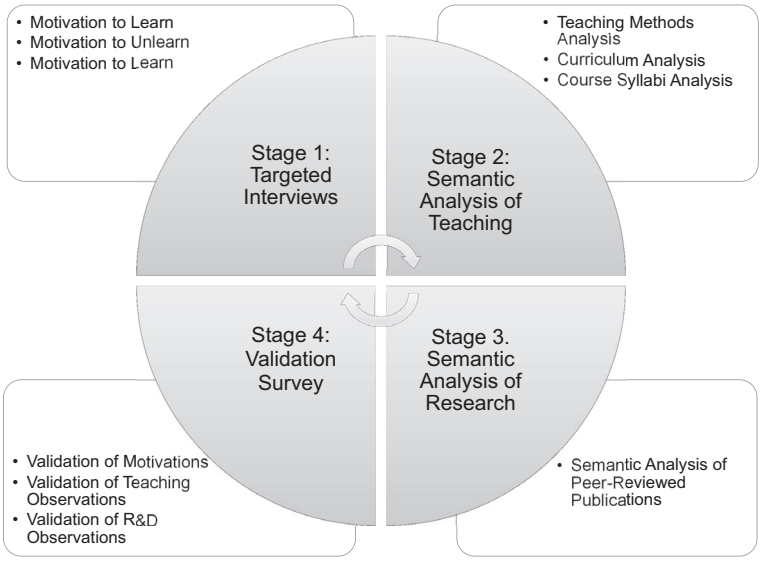


Fig. 3. Exploratory mixed methods research model.

research and were active in teaching graduate level courses. The original intent of the interviews was to provide insights into faculty perceptions of the incentives and impediments to learning, unlearning and relearning. The interviews were structured around a series of predefined questions. Six questions addressed demographics, including years of teaching, research and practical experience in the field, number of total years in the field, the age of their LIS program, and current title, areas of expertise, and primary research areas. Four questions addressed learning habits and attitudes, including specific learning strategies and sources within the field, learning strategies and sources outside of the field, organizational incentives to support learning, and constraints or impediments to learning. Unlearning habits and attitudes were addressed in a case based approach. Interviewees were asked to share an experience that caused them to reconsider a widely held assumption, theory or practice, and the impact this had on their work. Interviewees were asked to describe an experience where they had to relearn some aspect of their professional knowledge. Finally, interviewees were asked to explain how they incorporated these experiences into their teaching.

The responses to the interview questions were highly consistent. The consistency pertained to the nature of the academic environment, and rewards and recognitions that are inherent to the tenure and research funding models. Learning strategies most often cited focused on reading peer-reviewed articles in professional journals and books, and attending conferences sponsored by professional associations in the field. It was rarely the case that faculty participated in trade conferences or in conferences outside of their areas of expertise. For the most part, faculty did not participate in

other learning activities such as seminars, workshops, webinars, What was somewhat surprising was the low level of interaction faculty had with other faculty in other LIS programs or other departments. The motivation to learn clearly is tied to the goal of achieving tenure. Incentives were tied to faculty status and financial security. Lack of financial support was the most often referenced impediment to learning. With one exception, faculty had difficulty identifying unlearning and relearning examples.

The high rate of consistency in learning strategies and sources, incentives and impediments was revealing. Rather than proceed to a national survey which we understood would produce similar results, we restructured the research. The interview results signaled a need to develop a deeper understanding of learning, unlearning and relearning based on practical evidence – products and services generated in library and information science teaching, research and development. We shifted the survey to Stage 4 and recast it as a tool for validating the results of the evidence based investigation.

### *2.2. Stage 2. Learning, unlearning and relearning in teaching*

Stage 2 was designed to identify evidence of learning, unlearning and relearning in teaching. We suggested that teaching is comprised of three primary components, including (1) teaching and instructional methods; (2) curriculum; and (3) course syllabi. In order to explore learning, unlearning and relearning in all three components, we broke the general research question into three subsidiary research questions. First, we wanted to understand whether faculty were learning, unlearning and relearning in relation to teaching methods. Second, we wanted to understand how LIS curriculum reflected an ongoing cycle of learning, unlearning and relearning. Finally, we wanted to understand how faculty learning was reflected in the development of course syllabi.

#### *Research Question 1a: Evidence of learning, unlearning and relearning in teaching and instructional methods*

Research Question 1 focused on discovery of evidence of learning, unlearning and relearning in LIS teaching. The targeted interviews suggested that LIS faculty learn how to teach through experience, through on the job learning, by trial and error, or learning from mentors. Historically, most instructional learning by faculty revolved around episodic workshops that introduced faculty to new or targeted teaching methods. Though some faculty learning communities can be traced back to the 1970's, most date to the 1990s [52]. Faculty learning communities have formed among academic faculty within and across disciplines. A faculty learning community is defined by Layne et al. [53] as a sustained model for professional development. It is an on-going community that come together to explore and consider new ideas, perspectives and techniques related to teaching. We found evidence of online communities of practice across schools and colleges [53,54], general faculty learning communities [55,56,57], learning communities that target career phases of faculty

members [58], collaborative teaching models and communities [59], faculty learning teams devoted to science and mathematics teaching [60], cross-disciplinary faculty learning teams, and faculty-business school customer learning communities [61].

Most of the faculty learning communities appear to include all three stages of the learning life cycle, though the heaviest emphasis is on learning. This makes sense because most faculty come to teaching needing to learn. What we observed was midcareer or senior faculty unlearning or relearning. And, often in connection which a change from teaching in a physical, brick and mortar environment to teaching in an online environment.

Where we did see some re-examination of teaching and instructional methods was in the new "Big Picture" schools [12]. These school are taking a critical look at the broader question of educational design, building teacher capacity and professional development. By definition the faculty at these schools are motivated to rethink teaching models. By definition, this will include learning, unlearning and relearning.

*Research Question 1b. Evidence of learning, unlearning and relearning in curriculum scope and coverage*

Research Question 2 explores how learning, unlearning and relearningare incorporated into LIS curriculum. An academic curriculum which is relevant to a 21st century knowledge economy will exhibit change over time. It will include a variety of types of learning methods, and it will include courses on emerging topics, cross-disciplinary topics, and practical skills based topics. The inclusion of these courses in the curriculum provides both faculty and students with opportunities to learn new things, to put outdated ideas to rest, and to relearn or supplement courses with new and adapted ideas.

To answer this question we examined the curricula of eight library and information science schools. Two of the sampled schools focused primarily on library science education, three focused on a blend of library and information science education, and three would be characterized as largely information science education (e.g., "I" Schools). In those curriculum supporting library science education, course scope and coverage maintained a close adherence to the standards established by professional associations and associated with accreditation processes (i.e., American Library Association, the Association for Library Service to Children, and Young Adult Library Services Association, and others). The scope and coverage of curricula supporting a blend of library and information science topics reflected the former standards but also included courses pertaining to specialized types of libraries (American Association of Law Libraries, Association of College and Research Libraries, Federal Library and Information Center Committee, Medical Library Association, Music Library Association, Society of American Archivists, and Special Libraries Association) and specialized types of information (Map and Geography Round Table, North American Serials Interest Group, Art Libraries Society of North America. Art Libraries Society of North America). In both of these cases, there was little evidence

of topics that were outside of these association-defined areas. In contrast, there is evidence of more contemporary and cross-disciplinary topics in the curricula of "I" Schools or those programs that focus on the discipline more broadly. Our preliminary observations suggest that learning, unlearning and relearning in curriculum design aremore evident in I Schools that in schools whose focus is on library and information science.

Another issue that surfaced during the curriculum review was the heavy reliance on external adjunct faculty to teach contemporary or cross-disciplinary topic courses. The strategy of bringing in external experts to teach specialized topics may be productive for students. However, it may add disincentives to full-time faculty learning. Where full-time faculty are teaching these courses, we can assume they are learning and integrating that learning back into their teaching. Where faculty are not teaching these courses, there may be no need to learn, and thus no opportunity to unlearn or relearn. This cycle encourages teaching the same topics over time without adaptation. This is what we observed in tracing some of the syllabi for courses over a period of several years. Where external experts are brought in to teach courses, there is a need to support knowledge transfer and exchange with the full-time faculty.

The observations from this stage of the research will be incorporated into the national survey instrument to probe full- and part-time faculty teaching practices.

*Research Question 1c. Evidence of learning, unlearning and relearning in LIS course syllabi*

We examined the course syllabi of master's level education programs to find evidence of learning, unlearning and relearning. Our expectation was that learning would be demonstrated by the inclusion of new topics or contemporary research in the syllabi. Our expectation for evidence of unlearning was to find some topics removed from syllabi in preference for new or adapted topics. In total, we collected 1,711 syllabi from seven graduate level programs (Table 2). Of the seven programs represented in the sample, two represent a Library Science focus, two represent a combined Library and Information Science focus, and three represent an "I" (Information) School focus. In total, the syllabi represented 268 courses across the seven programs, representing on average 38.28 courses per program. The syllabi represented from 1 to 7 years of coverage.

Syllabi were reviewed manually and at a machine level. The machine level review took the form of a semantic analysis. The SAS Content Categorization Suite technology was used for a first pass. The goal of the first pass was to discover what subject areas and topics were covered in the syllabi. We rationalized that tracking subject areas and topics over time would illustrate shifts in focus or the emergence of new course coverage. It was important not to pre-define the subject areas or topics – to avoid prejudicing the results. In order to discover all topics and subjects, we extracted noun phrases using natural language processing methods supported by the SAS tools. A natural language processing profile (Fig. 4) was developed and tested. Noun phrase extraction is not the same as key word or word extraction. It

Table 2
Descriptive statistics noun phrase extraction in syllabi

| Institution | Focus of school | No. of syllabi |
|---|---|---|
| School 1 | Library Science | 945 |
| School 6 | Library Science | 64 |
| School 2 | Library and Information Science | 258 |
| School 5 | Library and Information Science | 190 |
| School 3 | I School | 161 |
| School 4 | I School | 24 |
| School 7 | I School | 69 |
| Total syllabi | | 1,711 |

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# Adjective/Noun
*PHRASE = :A :N
*PHRASE = :A :Np1
*PHRASE = :A :Np1 :N
*PHRASE = :A :N :N
*PHRASE = :A :N :Np1
*PHRASE = :A :N - :N
*PHRASE = :A :N - :Np1
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*PHRASE = :Acomp :Np1
*PHRASE = :Acomp :N :N
*PHRASE = :Acomp :N :Np1
*PHRASE = :Acomp - :Ving :N
*PHRASE = :Acomp - :Ving :Np1
*PHRASE = :Asup :N
*PHRASE = :Asup :Np1
*PHRASE = :Asup :N :N
*PHRASE = :Asup :N :Np1
*PHRASE = :Asup :N - :N
*PHRASE = :Asup :N – Np1
*PHRASE = :Asup - :Ving :N
*PHRASE = :Asup - :Ving :Np1
*PHRASE = :A *PN
*PHRASE = :Acomp *PN
*PHRASE = :Asup *PN

# Adverb/Noun
*PHRASE = :Adv :N
*PHRASE = :Adv :Adv :N
*PHRASE = :Adv :Np1
*PHRASE = :Adv :A :N
*PHRASE = :Adv “A :Np1
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Fig. 4. Noun phrase extraction profile – SAS content categorization tool.

is not the same as topic clustering. The output of a noun phrase extraction is a full list of noun phrases for each document in the corpus. In this case, we generated a list of noun phrases for each syllabus in the test set. Our assumption was that the extraction would surface meaningful topics within and across syllabi. On average, the profile extracted 1,726 phrases per syllabus. The results provided a robust corpus for evaluation.

The noun phrases extracted from syllabi produced more administrative phrases than subject or topical phrases. We found that syllabi from LS and LIS programs contained surprisingly little knowledge about the substantive nature of the courses. On average, 70.44% of the noun phrases extracted from these syllabi by the semantic analysis technologies described administrative matters – assignments, academic poli-

cies, class behavior, class policies, and instructor contact information. Only 29.56% of the noun phrases extracted pertained to the subject matter of the course. The average percentage of noun phrases from "I School" syllabi was more balanced at 52.27% representing administrative concepts and 47.74% representing subject concepts.

A manual review of the syllabi was undertaken. The manual review validated the semantic extraction. We observed that a general practice in designing courses for LS and LIS education is to select and teach from textbooks. And, most of the syllabi in the test corpus referenced a single textbook. Some syllabi referenced supplementary textbooks. Textbooks – in some cases several years old – were the primary source of new knowledge for students. By and large, there were no other references to contemporary readings from peer-reviewed journals included in the syllabi. This observation did not hold for "I School" syllabi to as great an extent. Syllabi from "I Schools" tended to include references to professional journals at a higher rate than LS and LIS syllabi. This observation explained the higher percentage coverage of topical noun phrases extracted from "I" School syllabi.

These observations must be validated in the larger survey and by querying faculty as to their practices in course design. While there were a large number of syllabi included in the test corpus, the analysis would benefit from broader coverage of programs. The semantic analysis and the manual review are suggestive of practices that should be validated by faculty.

If these results are reliable and can be trusted, the implications for learning, unlearning and relearning are concerning. One potential implication of this exercise is that master's programs in LS and LIS remain at introductory levels. Students are not being introduced to current research in the field. This raises the question of how research is being introduced to students and how they continue to access it once they transition to professional roles. The incentives for learning, unlearning and relearning in course coverage are unclear here.

"I School" courses tend to treat more contemporary and cross-disciplinary topics. For this reason there is not likely to be a single textbook that covers the knowledge base of the course. This explains why these syllabi leverage peer-reviewed articles, white papers, and chapters from a range of books. In these cases, we can see how research is feeding back into teaching. We can see where and how faculty are integrating their learning into teaching. The incentives for learning, unlearning and relearning in course coverage are clear in this context.

### *2.3. Stage 3. Learning, unlearning and relearning in faculty research*

Doctoral level education and research is the primary source of preparation for undertaking academic research. We expect to see high levels of learning, unlearning and relearning in the published research of academic faculty. This is the primary skill set they bring to the position. While accreditation guidelines and standards may

Table 3
Representation of learning, unlearning and relearning semantics

| Process | Semantic markers |
|---|---|
| Learning | ascertain@, aware@, create@, create@, detect@, determine@, develop@, diagnose@, disclose@, discover@, empiric@, encounter@, evolve@, experiment@, explore@, expose@, find@, identif@, introduce@, invent@, learn@, new@, origina@, perceive@, progress@,, reveal@, sense@, spot@, uncover@, unearth@, unveil@,valid@, verif@ |
| Unlearning | amiss@, contrary@, counterfactual@, defective@, deficient@, delusive@, disregard@, erroneous@, expired@, fallacious@, false@, faulty@, flawed@, illogical@, improper@, inaccurate@, incorrect@, inexact@, inoperative@, insufficient@, Invalid@@, irrelevant@, misguided@, misleading@, misrepresentative@, mistaken@, not relevant@, obsolete@, out of date@, overlook@, pass over@, rethink@, unfounded@, unlearn@, ungrounded@, unreasonable@, unreliable@, unsound@, untrue@, wrong@ |
| Relearning | adapt@, amend@, change@, different@, emend@, rearrange@, reassess@, recapitulate@, recheck@, reconsider@, reconsideration@, redo@, reevaluate@, reexamine@, reflection@, refresh@, relearn@, renovate@, replace@, replan@, reread@, reshape@, rethink@, retrace@, retrospect@, revalid@, review@, revise@, reweigh@, rework@, second thoughts@, take another look@ |

- Cataloging and Classification Quarterly
- Children and Libraries
- College and Research Libraries
- D-Lib
- Information Processing and Management
- Journal of Digital Information
- Journal of Research on Libraries and Young Adults
- Journal of the American Society for Information Science and Technology
- Library Administration and Management
- Library Trends
- Public Libraries
- Reference and User Services Quarterly

Fig. 5. Journals contributing articles for faculty research test corpus.

provide an explanation for the lack of learning, unlearning and relearning evident in teaching, there should be no such constraint or impediment in research.

A second corpus was created to explore learning, unlearning and relearning in faculty research products. A research corpus was created, comprised of 432 peer reviewed journal articles. The articles were drawn from twelve peer reviewed journals (Fig. 5). Journals represented all functional areas of the discipline including reference and user services, technical services, systems and technology, administration, children's and young adult services, Articles were also drawn from journals focused on many types of libraries including public libraries, college and research libraries, and children's libraries. We included in the corpus a full year of substantive research articles from each journal.

Discovering evidence of learning, unlearning and relearning in published research is a challenging task. The first challenge is to characterize what we mean by learning, unlearning, and relearning. We took a semantic approach to characterizing these three practices. We leveraged the SAS semantic technologies. We developed a semantic profile designed to extract adjectives, adverbs and noun phrases. The seman-

Table 4
Occurrence rates of learning semantics in research papers

| Concepts | Occurrence | % total concepts | Concepts | Occurrence | % total concepts |
|---|---|---|---|---|---|
| new@ | 1,986 | 1.06% | reveal@ | 130 | 0.07% |
| develop@ | 1,008 | 0.54% | aware@ | 129 | 0.07% |
| learn@ | 851 | 0.45% | progress@ | 84 | 0.04% |
| find@ | 845 | 0.45% | perceive@ | 71 | 0.04% |
| experim@ | 499 | 0.27% | verif@ | 42 | 0.02% |
| origin@ | 444 | 0.24% | encount@ | 39 | 0.02% |
| identif@ | 407 | 0.22% | diagnose@ | 27 | 0.01% |
| introduce@ | 314 | 0.17% | spot@ | 27 | 0.01% |
| empiric@ | 277 | 0.15% | expos@ | 25 | 0.01% |
| percep@ | 243 | 0.13% | invent@ | 22 | 0.01% |
| detect@ | 230 | 0.12% | evolve@ | 14 | 0.01% |
| explor@ | 229 | 0.12% | uncover@ | 11 | 0.01% |
| sense@ | 212 | 0.11% | disclose@ | 9 | 0.00% |
| valid@ | 209 | 0.11% | ascertain@ | 1 | 0.00% |
| discover@ | 202 | 0.11% | unearth@ | 0 | 0.00% |
| create@ | 178 | 0.09% | unveil@ | 0 | 0.00% |
| determine@ | 137 | 0.07% | | | |

Table 5
Occurrence of rates of unlearning semantics in research papers

| Concepts | Occurrence | % total concepts | Concepts | Occurrence | % total concepts |
|---|---|---|---|---|---|
| unreliable@ | 279 | 0.15% | pass over@ | 4 | 0.00% |
| error/n@ | 207 | 0.11% | flawed@ | 3 | 0.00% |
| counter@ | 90 | 0.05% | disregard@ | 2 | 0.00% |
| false@ | 54 | 0.03% | inexact@ | 2 | 0.00% |
| fallacious@ | 53 | 0.03% | expired@ | 1 | 0.00% |
| faulty@ | 34 | 0.02% | rethink@ | 1 | 0.00% |
| incorrect@ | 33 | 0.02% | amiss@ | 0 | 0.00% |
| irrelevant@ | 28 | 0.01% | delusive@ | 0 | 0.00% |
| insufficient@ | 24 | 0.01% | illogical@ | 0 | 0.00% |
| contrar@ | 23 | 0.01% | inoperative@ | 0 | 0.00% |
| mistaken@ | 21 | 0.01% | misguided@ | 0 | 0.00% |
| deficient@ | 19 | 0.01% | misrepresentative@ | 0 | 0.00% |
| inaccurate@ | 14 | 0.01% | not relevant@ | 0 | 0.00% |
| defect@ | 7 | 0.00% | outdate@ | 0 | 0.00% |
| misleading@ | 7 | 0.00% | unfounded@ | 0 | 0.00% |
| obsolete@ | 7 | 0.00% | ungrounded@ | 0 | 0.00% |
| overlook@ | 6 | 0.00% | unreasonable@ | 0 | 0.00% |
| improper@ | 4 | 0.00% | unsound@ | 0 | 0.00% |
| Invalid@@ | 4 | 0.00% | untrue@ | 0 | 0.00% |

tic profile was applied to each of the 432 articles. A single integrated file of 187,396 phraseswas generated. To reiterate the point made earlier, phrases are multiword concepts and do not represent simple keywords. Against this corpus of extracted phrases, we looked for evidence of semantic markers that were suggestive of learning (Table 3), of unlearning (Table 4) and of relearning (Table 5). Each semantic marker listed was expanded to include all grammatical variations, designated by the @ sign.

Table 6
Occurrence of rates of unlearning semantics in research papers

| Concepts | Occurrence | % total concepts | Concepts | Occurrence | % total concepts |
|---|---|---|---|---|---|
| different@ | 2,218 | 1.18% | reshape@ | 1 | 0.00% |
| review@ | 872 | 0.47% | rethink@ | 1 | 0.00% |
| change@ | 649 | 0.35% | reassess@ | 0 | 0.00% |
| reflection@ | 180 | 0.10% | recapitulate@ | 0 | 0.00% |
| adapt@ | 75 | 0.04% | recheck@ | 0 | 0.00% |
| replace@ | 39 | 0.02% | reevaluate@ | 0 | 0.00% |
| retrospect@ | 20 | 0.01% | reexamine@ | 0 | 0.00% |
| redo@ | 13 | 0.01% | relearn@ | 0 | 0.00% |
| amend@ | 12 | 0.01% | replan@ | 0 | 0.00% |
| emend@ | 9 | 0.00% | reread@ | 0 | 0.00% |
| reconsider@ | 9 | 0.00% | revalid@ | 0 | 0.00% |
| retrace@ | 6 | 0.00% | reweigh@ | 0 | 0.00% |
| rearrange@ | 3 | 0.00% | rework@ | 0 | 0.00% |
| refresh@ | 3 | 0.00% | second thoughts@ | 0 | 0.00% |
| revise@ | 3 | 0.00% | take another look@ | 0 | 0.00% |
| renovate@ | 2 | 0.00% | | | |

This means that each term was expanded to include all of its grammatical forms. For example, disclose@ would include disclose, disclosed, disclosing, disclosure, and any other grammatical form represented in a standard dictionary.

The results of the review of extracted semantic markers are presented in Tables 4, 5, and 6. The semantic analysis represents only a first attempt to detect patterns and practices in the published LIS research. We acknowledge that there is room for expansion of the semantic markers. However, we believe the semantic analysis generated a good foundation upon which to base further inquiry. First, we note that all incidence rates are low for learning, unlearning and relearning markers. Consistent with earlier observations, though, the rate of incidence of learning markers is notably higher than for unlearning and for relearning (Table 4).

The rate of occurrence of unlearning markers (Table 5) is largely absent in the published peer-reviewed literature. This may be because we have an inadequate representation of unlearning concepts. It may also be because research "unlearned" research results may not be considered good candidates for publishing.

While the incidence rate for a few relearning semantic markers is notable (Table 6), the majority of terms never appear in the almost 200,000 phrase corpus.

The results of the semantic analysis suggest that greater emphasis is placed on learning and the presentation of new ideas in published research. Less attention is paid to experiences involving unlearning. Relearning may play into the research process, but it is not clear from these results how much of a role that might entail. The insights gained through the semantic analysis will serve as the foundation for questions included in the national survey.

### *2.4. Stage 4. National survey of library and information science faculty*

This phase of the research is just now underway. The survey instrument has been

redesigned based on the lessons learned in Stages 1, 2 and 3 of the research. The survey instrument now includes five sections, including (1) Demographics (6 Questions); (2) General Learning Habits and Attitudes; (3) Use of Learning, Unlearning and Relearning in Teaching Activities; (4) Use of Learning, Unlearning and Relearning in Research Activities; and (5) Full- and Part-Time Faculty Learning Exchanges.

## 3. Research results and observations

The research described in this paper is an example of learning, unlearning and relearning. The main focus of the preparation for research focused on knowledge management methods, specifically the knowledge life cycle and the learning life cycle models. The first stage of the research highlighted the need for a deeper understanding of incentives, impediments and common practices in the field of library and information science. The methodology was revised (e.g. unlearned) and adapted (e.g., relearned).

We offer eight observations from this exploratory research. While exploratory at this time, we believe these observations will be substantiated in the national survey.

- *Observation 1*. Knowledge management methods were an effective approach to surfacing important issues in the field of Library and Information Science. While the two fields have some overlap, they are in many ways orthogonal. The application of the KLC to LIS faculty practices surfaced some important learning challenges.
- *Observation 2*. If learning is the engine of growth in the knowledge economy and knowledge and intellectual capital are the fuel, the field of library and information science needs to increase the capacity of its engine and the power of its fuel. Incentives for learning should be increased and expanded.
- *Observation 3*. Unlearning or the invalidation of outdated, erroneous and irrelevant knowledge is a critical step in the knowledge life cycle. There is little evidence that unlearning or invalidation is taking place in the substantive aspects of teaching or in research. It may be the case that accreditation guidelines and standards are pre-empting this important step.
- *Observation 4*. Teaching of new topics or cross-disciplinary topics should be undertaken by full-time faculty as opportunities to learn, unlearn and relearn.
- *Observation 5*. We learned that the highest level of learning, unlearning, and relearning activity pertains to an area in which LIS faculty have little formal training – teaching and instructional methods. This suggests that where incentives exist, LIS faculty will implement a full KLC life cycle.
- *Observation 6*. The heavily administrative focus of course syllabi raised concerns that LIS faculty may be integrating current learning and research into their course designs.

- *Observation 7*. The heavy use of textbooks raised concerns about graduate level courses. Typically, we expect heavy textbook use for undergraduate courses, and a focus on more advanced topics in graduate level courses. The lack of integration of current research in the master's level education raised concerns. It is unclear professionals are being exposed to current research. We would expect graduate level courses to focus on ideas that have not yet made their way into published books but rather are part of the current professional dialog. Exceptions would be specialty research books which align with the course topic.
- *Observation 8*. Faculty do not appear to be participating in broad-based learning activities. And, they are rarely participating in learning activities outside of their immediate discipline. This suggests that opportunities for faculty to surface knowledge gaps is low.

## 4. Implications for future research

The research results are being integrated into an open and inclusive national survey that will be distributed in March, 2015. We expect the survey results to provide further insights into incentives and impediments, and to highlight practices that may benefit from unlearning and relearning. The goal of this research is consistent with its original intent – to enable the LIS faculty to remain a competitive and valuable source of new ideas and knowledge in the $21^{\text{st}}$ century knowledge economy.

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