What information competencies matter in today's workplace?*

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Abstract

This is a qualitative study about the information competencies that employers seek in university graduates and the skills which graduates demonstrate when they enter the workplace. Included are findings from interviews with 23 US employers and focus groups with a total of 33 recent graduates from four US colleges and universities. Employers said they recruited graduates for their online searching skills but once graduates joined the workplace they rarely used the traditional, low-tech research competencies that their employers also needed. Graduates said that they used skills from university for evaluating and managing published content; yet most graduates still needed to develop adaptive strategies to save time and work more efficiently. A preliminary model compares information problems in the university with those of the workplace. Opportunities are identified for preparing students to succeed beyond the academy in the workplaces of today and tomorrow.

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1 Introduction

For the past two decades, library and information science researchers have asked critical questions about the efficacy of information literacy instruction programs and students' information competencies in educational settings. Despite their extensive work, one question about information literacy remains largely unanswered: How prepared are today's students for finding, evaluating, and using information once they graduate and join the workplace?

In this paper, we present qualitative findings about the information competencies needed for solving workplace information problems. We studied this topic from two perspectives: that of the employers who hire graduates, and that of graduates who have recently started work.

During the winter and spring of 2012, we conducted 23 in-depth interviews with US employers about their evaluation of recent university graduates as information problem-solvers. We also moderated five focus group sessions with 33 recent graduates from US colleges and universities to explore the information competencies they applied and developed as they transitioned from university to the workplace.

The primary contribution of this paper is to provide understanding about what employers expect and need from graduates and what information skills many graduates bring to the workplace.

2 Literature review

The term "information literacy" first appeared in workplace discourse during the 1970s, indicative of the paradigmatic shift from the industrial to the digital age. In 1974, the president of the Information Industry Association called for an "information literate workforce" skilled at applying information resources in their daily jobs (Zurkowski, 1974). Within twenty years, this nascent goal was all but superseded by strategies for organizational knowledge sharing (Davenport and Prusak, 1998; Drucker, 1988; Nonaka and Takeuchi, 1995).

Further, in 1989 when information literacy became an essential element of the academic library's mission, competencies were codified into tangible, specific learning outcomes (Maughan, 2001). In its Presidential Committee Final Report, the Association of College and Research Libraries (ACRL) described information literacy as a set of standards and abilities for both recognizing when information is needed and having the skills to effectively find, evaluate and apply that information (ACRL, 1989). In 2000, ACRL updated its standards in response to pressing issues about the complexity of the information retrieval environment (ACRL, 2000).

Other research has shown a vital link between higher education, information literacy and lifelong learning (Blanchard, 2012; Candy, 2000, 1991; Hake, 1999; Istance, 2003; Jongbloed, 2002; Shanahan, 2007; Steur, Jansen and Hofman, 2012). This has influenced policies related to strengthening the response to the global economic downturn, in part due to labour force shifts with lifelong learning and vocational education and training (VET) programs in the European Union

(European Centre for the Development of Vocational Training, 2011; Solidar, 2011).

Even before this, universities and government agencies had issued several relevant joint reports. These have two distinct views about why lifelong learning is integral to higher education: (1) to guarantee a competitive workforce in times of turbulent global change (CEC, 1995; OECD 1973); and (2) to promote personal growth and social equality, and enrich society (Cropley, 1977; DfEE, 1998; Faure et al., 1972).

Notably, the report by the Australian National Board of Employment, Education, and Training (NBEET) supports both the economic and cultural rationales that are needed for lifelong learning, while highlighting the importance of information literacy in achieving it (Candy, Crebert, and O'Leary, 1994). The authors conclude that lifelong learning skills – not disciplinary content – need to be at the core of the undergraduate experience. Five critical skills for lifelong learning were identified: an inquiring mind, "helicopter vision" (i.e., a cross-disciplinary approach), a sense of personal agency, a repertoire of learning skills, and information literacy.

Numerous books and studies have been devoted to information literacy instruction (Gavin, 2008; Head and Eisenberg, 2009, 2010; Radcliff, 2007; Warner, 2008; Oakleaf, 2008, 2011). Models for teaching and assessing the information problem-solving process have endured as seminal works (Andretta, 2005; Eisenberg and Berkowitz, 1988, 1990; Kuhlthau, 1994, 2004).

Despite an extensive collection of publications, the information literacy concepts and programs have their critics and limitations. Scholars have claimed that information literacy's singular confinement to the educational community has created a significant knowledge gap (Hultgren and Limberg, 2003; Kirton and Barham, 2005; Lloyd, 2010b; Lloyd and Williamson, 2008). Few library and information science journal studies have delved into the study of workplace information literacy and lifelong learning (Lloyd, 2010a; Lloyd and Williamson, 2008). Even fewer books have laid out an understanding of information literacy processes in the workplace (Goad, 2002; Lloyd, 2010b).

In the remainder of this review section, we summarize the comparatively small body of research that has investigated information literacy beyond educational institutions. We divide our review into three sections: (1) early studies of the workplace information literacy process by profession, (2) research into the social side of workplace research, and (3) employers' perceptions of information literacy.

2.1 Early studies

The availability and use of commercial databases increased in the 1970s and 1980s. Research was conducted about scientists (Crawford, 1971; Gralewska-Vickery, 1976; Pinelli et al., 1993; Price, 1963), research and design teams (Rosenbloom and Wolek,1967), physicians (Stinson and Mueller, 1980; Strasser, 1978), academics (Hurd, Weller and Curtis, 1992; 1996), attorneys (Cohen, Berring, and Olsen, 1989), nurses (Blythe and Royle, 1993; Corcoran-Perry and

Graves, 1990), and engineers (King, Casto, and Jones, 1994). Despite this substantial body of literature about the information-seeking behaviour of highly trained professionals, few generalizable models emerged about how workers, as a whole, conducted workplace research across a variety of industries and occupations.

One attempt to develop a model of workplace information literacy followed (Bruce, 1999). Christine Bruce examined how professionals at universities in Australia (n=60) conceptualized and practiced information literacy in the course of their work. Bruce applied a phenomenographic investigation from higher education to reveal "seven faces of information literacy" (Bruce, 1997, 1999). Each of Bruce's constructs was mapped to how individuals may experience information literacy in the workplace. Bruce concluded information literacy is critically relevant at both the individual and team level in learning organizations, and in a broader sense, to lifelong learning.

Delving into the process of workplace research, Bonnie Cheuk constructed a model for workplace information literacy based on in-depth interviews (n=6) with mid-career auditors in Singapore (Cheuk, 2008). Her two-stage model traces the workflow of an auditor's effective use of information using information consumption and information supply. Cheuk's consumption stage is characterized by an iterative process of task definition and seeking and using information; the supply stage is marked by a similarly iterative process of defining objectives and presenting a subset of gathered information. The strength of Cheuk's research is her model's recursive approach, which is less linear than models emphasizing information presentation and information seeking, such as Eisenberg's and Berkowitz's Big6 model (1990).

One limitation of the early studies about workplace information literacy has been the emphasis on studying "white collar" professions. A few of these studies investigated the information seeking behaviour of workers in vocational and technical fields, such as dental assisting, law enforcement and rescue, nursing, air conditioning, or construction management (Birdet al., 2012; Bruce, 1999; Cooney, 2005; Lloyd, 2010b). A line of research about the social side of workplace learning explored new territory by investigating the information practices of workers in vocational and paraprofessional jobs.

2.2 Social side of workplace learning

The importance of human relationships for sharing and fostering information literacy practices runs through the social learning literature (O'Farrill, 2010; Crawford and Irving, 2009; Somerville, Howard, and Mirijamdotter, 2009; Weiner, 2011). Intertwined with this discussion is the broader concept of communities of practice, or situational aspects of learning (Lave and Wenger, 1991; Wenger, 1998, Brown and Duguid, 1991, DePalma, 2009). Brown and Duguid (1991) argued social interactions are highly contextualized and developed in situ as new employees become insiders to the community's shared meanings for understanding complex activities. Wenger's (1998) classic case study of insurance claims processors highlights the degree to which newer employees turn to more experienced colleagues to learn procedural and standard practices.

DePalma's (2009) study of a group of social activists analysed the possibilities of learning in organizations that are more fluid and transformative in their organizational goals.

Annemaree Lloyd has expanded this work using constructivist grounded theory to study how cultural tools and activity shape individuals' learning and information-seeking behaviours. Lloyd found that there was a key difference in how information is handled between the "blue-collar" trades and the "white-collar" professions (Lloyd 2005; 2010b). In vocational settings – where hands on training and embodied knowledge is critical – graduates sought out and relied on highly contextualized information, learned from co-workers in order to get tasks completed. In contrast, graduates working in white-collar professions tended to rely on finding and using published sources of information, in order to conduct comprehensive research for better understanding and resolving information problems.

Using a series of semi-structured interviews (n=20), Lloyd investigated workplace information literacy and firefighters' reliance on three sources of information: (1) textual sources to master institutional practices, (2) social information to learn workplace views of practice, and (3) embodied learning to learn observable practices from co-workers (Lloyd, 2005). In a subsequent study, Lloyd studied ambulance officers, paraprofessionals in Australia (Lloyd, 2009). In this work, Lloyd argued for recasting information literacy as a holistic practice of engagement and connection with social and physical experiences with information, thus making information literacy more transferable across education, the workplace and lifelong learning.

Lloyd has argued in a later work that information literacy can be understood as an information practice (Lloyd, 2010a). She has described information literacy practices as being a collection of "information-focused activities that are constituted within larger integrative practices" that may vary depending on certain contexts, including educational and workplace settings (Lloyd, 2010a, 249). Lloyd's argument is influenced by US philosopher Theodore Schatzki's discussion of social practices as being organized by understandings, rules, and "teleoaffective structures" (Schatzki, 2002).

Other researchers have taken a social constructivist approach, pointing to the critical role of communities of practice for developing information literacy in the workplace by drawing on studies of health care workers, social workers, and civil servants (Crawford and Irving, 2009). Eraut (2007) has discussed the importance of new employees' asking questions and locating key people who can serve as information resources.

Hepworth and Smith (2008) interviewed eleven non-academic university staff, who reported using strategies such as social networking to identify and interpret information problems. Subjects reported that the social skills necessary to successfully network in solving information problems were essential, yet they reported time pressures kept them from more thoroughly tackling information tasks.

One strength of this group of studies is its emphasis on how learning and knowing occurs in organizations. At the same time, a shortcoming is its concentration on a few professions instead of across organizations and industries.

2.3 Employers' perceptions of information literacy

More recently, studies have been published about employers' perceptions of information literacy needs throughout the workplace. Conley and Gil (2011) surveyed US employers (n=55) at a careers fair about their awareness of and views on information literacy skills. Most employers were unfamiliar with the phrase "information literacy", yet they agreed it was important for employees to be able to find, evaluate, and use information. Most reported that business school graduates lacked these skills.

Klusek and Bornstein (2006) analysed quantitative data from an occupational information database to correlate ACRL information literacy standards with employers' job specifications in business and finance. The authors concluded information literacy skills were core competencies for most business and finance careers, not a specialized set of skills of a certain job title.

Sokoloff (2012) interviewed professionals (n=15) who supervised recent graduates from a US business school, asking them about information seeking and use in their workplaces, and about the preparedness of graduates to meet these needs. Sokoloff found employers frequently had a difficult time distinguishing information literacy and research skills from other skills such as presentation, writing, and technology competency. Moreover, employers reported they did not assign research tasks to new recruits unless they were to be assisted by senior staff.

In 2011, the National Association of Colleges and Employers (NACE) asked US employers (n=244) how much importance they attached to various workplace skills when recruiting graduates. For each skill, respondents gave a rating on a scale from 1 to 5, where 1 meant "not important" and 5 meant "extremely important". "Obtaining and processing information" ranked fourth in a list of ten skills. On average, respondents rated it 4.46: somewhere between "very important" and "extremely important" (NACE, 2011; see Table 1).[1]

Taken together, these studies show that employers place a higher premium on graduates' information competencies. Yet the results of these employer surveys do not say which information competencies are important in the workplace and why. Very little is known about how university graduates make the critical information transition from college to the workplace and how they adapt and learn information skills in new settings.

[1] After our study had concluded, a new NACE study reported in its 2013 Job Outlook that employers ranked "obtaining and processing information" fifth out of ten skills they considered important during the recruiting process.

Skill / Quality	Ranking
1. Ability to work in a team structure	4.60
2. Ability to verbally communicate with people inside and outside the organization	4.59
3. Ability to make decisions and solve problems	4.49
4. Ability to obtain and process information	4.46
5. Ability to plan, organize and prioritize work	4.45
6. Ability to analyse quantitative data	4.23
7. Possession of technical knowledge related to the job	4.23
8. Proficiency with computer software programs	4.04
9. Ability to create and/or edit written reports	3.65
10. Ability to persuade or influence others	3.51

Table 1: Relative importance of skills of new recruits (taken from the *NACE 2011 Job Outlook* with the permission of the NACE, copyright holder).

The purpose of our research study was to address these limitations by collecting and analysing data about the information competencies that employers need and expect from graduates, and what graduates may contribute from their college learning experiences. Findings from employers and graduates are insightful and valuable for understanding the preparedness of college graduates for solving information problems across the workplace where many will spend a large part of their lives.

3 Methodology

The goal of our study was twofold:

1. to understand what employers need from graduates;
2. to explore what skills and strategies today's graduates demonstrate.

The research questions were as follows:

1. What information competencies do employers need from graduates at the hiring stage?

2. How do newly-recruited graduates approach solving information problems in the workplace, according to employers?

3. What information practices and strategies do newly-recruited graduates say that they adapt, use, and develop for solving information problems once they join the workplace?

We interviewed employers and conducted focus groups with a sample of recent graduates to gather qualitative data. Both methods allow for asking open-ended questions so that the discussions can freely explore new areas of research and examine complex questions.

3.1 Phase one: employer interviews

We conducted 23 telephone interviews with employers, each lasting between 45 and 60 minutes. For each organization, we interviewed one person who hired, trained, and / or supervised recent university graduates in entry-level positions and

/ or post-college internships. Our sample of organizations included a range of industries, such as engineering, financial services, government, media, technology, and transportation.

Employer	Location	Employees	Industry
Battelle Memorial Institute	Columbus, OH	24,500	Engineering
BlueKai	Bellevue, WA	42	Technology (consumer products)
Brookings Institution	Washington, D.C.	450	Policy / research
Capital Fellows Program	Sacramento, CA	11	Government / educational
Credo Reference	Boston, MA	14	Technology (library sector)
Discovery Communications	New York, NY	4,600	News / media
FBI	Washington, D.C.	38,850	Government
Fluke Manufacturing	Everett, WA	4,000	Manufacturing
Fred Hutchinson Cancer Research Center	Seattle, WA	3,207	Healthcare / research
KPMG	Seattle, WA	140,000	Financial services
Marriott International, Inc.	Bethesda, MD	120,000	Hospitality (lodging)
The Media Consortium	Washington, D.C.	2	Media / news (non-profit)
Microsoft	Redmond, WA	90,000	Technology (consumer products)
Mother Jones	San Francisco	59	Media / news
Nationwide Insurance	Columbus, OH	36,023	Financial services
OCLC	Dublin, OH	1,058	Technology (library sector)
Pariveda Solutions	Dallas, TX	350	Management consulting
Port of Los Angeles	San Pedro, CA	16,000	Transportation
The Press Democrat	Santa Rosa, CA	316	News / media
Price Pump	Sonoma, CA	27	Manufacturing
Serial Solutions	Seattle, WA	200	Technology (library sector)
Smithsonian	Washington, D.C.	6,300	Government (museums)
SS&G Financial Services, Inc.	Cleveland, OH	414	Financial services

Table 2: Employers interviewed (n=23 U.S. organizations).

We obtained our sample from multiple sources, including postings on career websites, such as Vault.com, and from career placement services on campuses. Table 2 gives the organizations in our interview sample; Table 3 gives the characteristics of the interviewees from these organizations, and of the new recruits whom they discussed.

Employer-interviewee details	Frequency	Relative freq.
Gender		
Female	9	39%
Male	14	61%
Job title of interviewee		
Executive level director/manager	9	39%
Mid-level manager	9	39%
Professional staff (e.g., attorney, librarian)	5	22%
Years employed at organization*		
1–4 years	8	35%
5–8 years	6	26%
9–15 years	2	8%
Over 15 years	7	30%
Disciplinary fields of recruits discussed*		
Arts and humanities	10	43%
Business administration	5	22%
Engineering	3	13%
Social sciences	2	9%
Computer science	1	4%
Occupational programs (e.g., nursing)	1	4%
Sciences	1	4%

* *Percentages may not add up to 100% due to rounding.*

Table 3: Employer-interviewees (n=23 representatives of U.S. organizations).

We asked employers open-ended questions in audio recorded, semi-structured interviews, covering three topics:

1. employers' expectations of graduates as information seekers and users;

2. employers' assessments of the strengths of graduates in solving information problems in the workplace;

3. employers' assessments of the weaknesses of graduates in solving information problems in the workplace.

In our interviews, we used the terms solving information problems interchangeably with research.

Once the sessions concluded, we used a latent coding method for analytic reduction and interpreting underlying patterns in the data. The coding guide followed Costa and Kallick (2008).

3.2 Phase Two: Focus groups with graduates

We moderated five focus groups with a total of 33 recent graduates from four U.S. colleges and universities. We used one-hour sessions to collect data about their

research habits, behaviours, and experiences in the workplace. Educational institutions represented in the focus groups were one four-year public institution, two four-year private institutions, and one two-year community college.[2]

We defined *recent graduates* as students who had graduated in the last six years (2005–2011) with a BA or a BS from a four-year institution, or in the case of community colleges, an AA. We excluded potential participants from the sample who were enrolled in any kind of graduate program at the time of the interviews. We obtained a random sample of graduates by collaborating closely with the library and foundation office at each institution in our sample. The foundation office was able to provide us with a random sample of graduates who lived with 30 miles of the institution from which they graduated and for whom the institution had email addresses they were willing to share for the study. Details of the sample of recent graduates are given in Table 4.

Before the sessions began, each participant was given a $10 Amazon gift card as a thank you for his or her time. A PIL moderator led an audio-recorded discussion about three topics:

1. the types of information problems that participants had encountered;
2. differences between solving information problems in the workplace and solving them at university;
3. competencies and strategies used for solving information problems.

The distinction between competencies and strategies is described in detail below.

Afterwards PIL moderators identified the most frequently occurring trends. Trends were divided into three categories, including participants' discussion about:

1. the difficulties of moving from university to the workplace;
2. preparedness for solving information problems in the workplace;
3. strategies that graduates used to adapt themselves to the workplace.

During our analysis, we defined *competencies* as the skills and knowledge needed to solve an information problem. We defined *strategies* as deliberate plans, often highly individualized, and utilizing competencies to achieve an objective, depending on the problem and other constraints. For the purpose of our study, we have defined *information practices* as the information-related activities individuals repeatedly engage in for solving information problems while integrating these activities into the larger workplace context and their understandings of rules, structures and organizational goals.

[2] These were: Harvard College (Massachusetts), University of Puget Sound (Washington State), University of Texas at Austin (Texas), and Santa Rosa Junior College (California).

Graduate Demographics	Count	Frequency
At a glance		
Total number of US campuses	4	100%
Total number of one-hour sessions	5	100%
Total graduates in focus groups	33	100%
Gender		
Female	20	61%
Male	13	39%
Age range		
23 to 25 years old	16	49%
26 to 30 years old	12	36%
Over 30 years old	5	15%
Undergraduate major *		
Arts and Humanities	10	30%
Sciences	7	21%
Social Sciences	7	21%
Double Majors	5	15%
Occupational training, inc. nursing	3	9%
Business Administration	1	3%
Current employment status		
Full-time employment	24	73%
Part-time employment	6	18%
Self-employed	1	3%
Not currently employed	2	6%
Year of Graduation *		
2011	4	12%
2010	6	18%
2009	11	33%
2008	4	12%
2007	4	12%
2006	1	3%
2005	3	9%
Grade Point Average (GPA)		
3.0 and lower	7	22%
3.1 to 3.3	9	27%

3.4 to 3.7	13	39%
Over 3.7	3	9%
Declined to state	1	3%

** Percentages may not add up to 100% due to rounding.*

Table 4: Graduate focus groups (n=33 graduates).

3.3 Methodological limitations

The response rate to our call for focus group participation for college graduates was extremely low: less than one percent at most institutions. There are several plausible explanations for the low response rate: limited interest in "post college" email, a suspicion that the email was for fundraising, or no interest in being involved with the institution after graduation.

We incorporated *methodological triangulation* into our study design. Social scientists have long argued that using more than one method to gather data increases the validity and accuracy of results (Cohen, Manion and Morrison, 2007). In our study, triangulation involved the use of two qualitative methods – employer interviews and the recent graduate focus groups – to cross-verify overarching trends we discovered about workplace information literacy.

4 Findings

Because of the design of this study, we were able to compare and contrast findings between employers and graduates. In this section, we introduce employers' baseline expectations of new graduate recruits as information seekers and users, as described in employer interviews. We also detail the competency gaps employers observed graduates to have in the workplace: this allows us to compare employers' needs to graduate performance in the workplace. Finally, we contrast the information problem-solving strategies employers highly valued with the strategies graduates used to meet employers' expectations.

4.1 Graduates in the workplace: the employers' view

Employer expectations proved surprisingly consistent, regardless of industry or the positions graduates accepted upon entering the workforce. Nearly all the employers we interviewed said they expected candidates to have *the ability to search online*. This catch phrase indicated any number of tasks: knowing how and where to search on the open Web, manipulating and analysing data using software such as Microsoft Excel or Access, or demonstrating competencies related to proprietary database searches, such as in Lexis-Nexis and / or THOMAS. In other cases, employers said they looked for standouts who demonstrated experience in plumbing the depths of the Web and synthesizing information from threads found on blogs, wikis, or Facebook.

Taken together, the large majority of employers had similar expectations for *baseline information competencies*. The most frequently mentioned skills included knowing how and where to find information online, without much guidance, to use a search strategy beyond the first page of Google results, and to articulate a "best solution" and conclusion from all that was found. While

employers said they required graduates to come with these search basics, they also assumed that additional training and mentoring would fill in some gaps. As one employer explained, "They have to learn that research here is a slow process and you don't just get the quick answers."

Employers such as this one assumed recruits would need to learn their workplace's iterative problem-solving processes and to understand how they differed from undergraduate research. As a result, most employers placed a higher premium on candidates who exhibited openness to learning and natural curiosity. Few, if any, employers interviewed expected graduates to come to the workplace with a complete knowledge of industry-specific resources or procedures.

Employers reported they assigned a wide variety of research tasks to graduates. For example, newcomers were tasked with locating information about industry competitors, tax regulations, conference planning, or news coverage of a particular issue. They were asked to consult scholarly research, to identify potentially defective products, or to examine court documents or politicians' voting records. In other cases, graduates were asked to find information for software training materials and/or technical coding specifications.

When we zeroed in on the valuable information competencies graduates brought to the workplace, employers frequently mentioned their ease with computers. Many employers closely linked computer proficiency to the ability to find and use information. As one employer explained:

The contrast is so evident between us on one side and them on the other side. They are connected in a way that my generation wasn't, which gives them all this solid background. There's this whole vocabulary they come speaking, you say something to them and they say, "Oh, yeah, I can do that." Information? They find it, they take it, and they blend it, they mash it up, they repurpose it.

As this quote suggests, being Web savvy and computer literate may contribute to graduates' abilities with obtaining and processing information – a competency today's employers claim to value highly. While these competencies are necessary, employers understood they were insufficient on their own.

When we specifically asked employers to assess how adept new graduates were at finding and using information, many noted that the online proficiency they had prized at the recruiting stage turned out, in many cases, to be both limited and limiting. Most employers needed and expected new recruits to conduct research more rigorously and flexibly, while being able to size up and define information problems. One employer explained:

They do well as long as the what, when, why, and how is clear in advance. As long as it doesn't require them to go past using a basic search engine, that is. It's that their toolkit and their whole sense of searching is limited. So, you need to say, "You use these tools to look for these kinds of things and when you find a possible answer you need to evaluate it using this criteria." You really have to lay it all out there so it's more test-like, if you can circumscribe the request, the better and better they do.

4.2 The competency gap: employers' needs

Employers expected their employees to possess a broad range of information competencies. Most assumed graduates would bring skills beyond simple searching with them to the workplace (e.g. scoping out or defining a problem), but they found overall, research skills among newcomers were inadequate. We defined this *competency gap* as the distinctive difference between information competencies that employers described as essential, and employer evaluations of graduates' information problem-solving skills.

Based on analysis of interview data, we identified four of the most frequently discussed information competencies that employers said new graduates lacked:

1. engaging team members during research process;
2. retrieving information using a variety of formats;
3. finding patterns and making connections;
4. exploring a topic thoroughly.

The following sub-sections detail each of these information competencies for solving information problems.

4.2.1 Engaging team members during research process

Assessing the need for outside help and engaging team members requires interdependent thinking in order to share, discuss, interpret, and revise findings. Employers said graduates had more trouble with team communication strategies than with any other single aspect of the research process. Some employers explained that graduates routinely overlooked the valuable social resources around them, or viewed research as a fundamentally non-social task. Instead, graduates simply wanted to "go to Point A and then march all alone to Point B." Or in the words of another employer:

What we need is someone who will go out and explore on their own and then come back to the team and say, "Here's my best take, what do you think?" They need that ability to invite discussion and be able to redirect on the fly.

For employers, engaging team members was not only a workplace practice to be learned, but also often the most viable means of solving information problems. One employer told us that workplace research, unlike college research, is highly contextualized and collaborative – thus, workplace experience matters at least as much as facts, figures, or theories. Employers were dismayed by graduates' failure to recognize their colleagues as important information sources.

4.2.2 Retrieving information using a variety of formats

A good research strategy entails knowing when it is necessary to look beyond what can be found online. According to the employers we interviewed, this meant non-digital information sources, such as company reports, manuals, books, phone directories, old photographs, print libraries – and institutional knowledge. Employers were surprised that few graduates incorporated off-line information sources into their research process. Graduates, they suggested, sometimes fall prey to the mistaken assumption that they could find everything they needed online.

According to one employer:

Going through old records and stacks of paper and finding information in microfiche—they don't have enough patience to do that. To be able to decipher information out of an old book isn't there, but to find it on the Internet, find it on a Web site—it's quick, it's instantaneous, it's already put into a synopsis for them when they bring it up.

With each passing year, employers said, new recruits are less likely to leave their workstations; as one employer stated, "[graduates] believe the computer is their workspace, so basic interactions between people are lost". Employers told us that graduates needed to "move off the script", "be resourceful and look in every place", and "fact-check across multiple sources." Above all, they said their recruits need to "build a network for tapping into tacit knowledge" within the work organization.

4.2.3 Finding patterns and making connections

A valuable aspect of information synthesis involves analysing what has been found and comparing details that may appear in an array of sources. However, few graduates seem prepared to engage in this kind of higher-order thinking, according to the employers we interviewed. Specific observations included new recruits who could not extract critical information from materials, or had difficulty "distinguishing the noise from the solid material". Other employers described graduates who "get stuck in the mud trying to figure out what it all means", never reaching the information synthesis phase. We also found new recruits who were not necessarily habituated to finding useful patterns that held meaning:

They struggle with the broader challenge of cross-context integration – being able to pull in different sources and tie them together. For instance, the exceptional one might find a law review article and then be able to internalize what they found and tell how this article ties in with other things they have seen during their search.

Employers needed graduates to identify meaningful instantiations and to be able to argue for their importance or the value they add to solving the task at hand. As one employer said,

It's one thing to go on the Internet and get the information, it's another thing to see potential connections, so you can find out what is not so obvious, too.

By their own admission, however, employers often overlook an applicant's ability to make connections between seemingly disparate elements during the interview process and so this skill may appear to have little value in the workplace.

4.2.4 Exploring a topic thoroughly

A persistent, iterative approach to research leads to deep understanding of a given information problem and possible solutions. In our interviews, many employers claimed that graduates rarely conducted the thorough research required of them in the workplace. A frequent criticism of graduates was the premium they placed on finding the answer as quickly as possible:

Their ability to go deeper into the literature is very limited. I had a new graduate hire who only searched for papers on Google. And I said, "You're missing things, you need to usePubMed – everything is there", and he just responded, "Well, I did this quick search, and that's what I got." But that's not good enough. Others will use easy sources, like Table of Contents services, with keyword filters, but I don't use them. It's easy – but it's not the most comprehensive. They're just picking out the easy stuff. For example, reading a paper, I always find 10 papers in the references, and I think "Oh, I need those". But I don't think there's a lot of that desire to go deep. They expect information to be so easy to get, that when it's not, it's frustrating to them. They've lived in a world where it's always been there.

Workplace research requires a strategy that imagines *all* possible answers – rather than conducting a cursory search to arrive at a quick conclusion after a few keystrokes. Employers want graduates who can "jump into the messy situations", "read through stuff they may never use", and apply "the dogged persistence" that research in the workplace requires. Yet they found that few new recruits conducted workplace research with "patience" and "persistence".

In addition, even fewer graduates possessed "a high tolerance for ambiguity" about both questions being asked and the answers being found. As one employer explained, a comprehensive research approach is essential because it solves immediate information problems and also sheds light on related issues critical for future work – the lifeblood of any organization.

4.3 Graduates in the workplace: the employees' view

In the second phase of our study, we conducted focus groups of graduates who had left university between 2005 and 2011. In our sessions, we explored their perspective about being a recent graduate in today's workplace. Nearly three-quarters (73%) of the participants in our sessions had full-time jobs. They were employed in a variety of information-intensive positions, from accounting to researching to teaching; some participants were working in their chosen careers, while far more were uncertain about what direction their professional lives would take. We discovered that a primary part of newcomers' jobs required them to find, evaluate, and use information to solve problems on a daily basis.

Participants discussed the information competencies from college experience they leveraged and applied in the workplace. Most frequently, these competencies revolved around extracting quality information from published sources; participants discussed four information competencies they applied from college to solving information problems in their daily jobs (from most to least mentioned):

1. evaluating research sources;
2. reading texts closely and critically;
3. dealing with large quantities of information and synthesizing;
4. framing research questions for implementing an iterative research strategy.

Some of these competencies had been formally learned through coursework and interactions with professors or librarians. Other competencies appeared to be self-taught or acquired through an informal network of friends and/or classmates. More than any other competency, participants credited their college training with

making them critical evaluators of information. When they conducted workplace research, they routinely evaluated the currency and authority of the information source.

Competencies related to courses of study also aided graduates with their information tasks. The ability to determine the validity of scientific articles served some participants well: this involved knowing to look at sample size, and being able to detect bias in the findings and "figure out where the author was coming from." Other participants said they relied on their "close reading" competencies from humanities and composition courses when solving information problems in the workplace. As one participant explained:
In college, I learned how to read with the grain and then against the grain. I've learned to examine the source and the biases as I read. So, I read to agree and then I read with scepticism. It also helps to better evaluate the source.

Still other participants had learned the value of synthesizing large volumes of content, which they needed to do throughout their education, no matter what their major had been. The competencies honed at university helped them to find the best material for a research task:

I was a history major and I learned how to synthesize and evaluate the quality of information and I learned how to read a lot of different things that sort of said the same thing and pick which one said it best and why it said it best. Some of it is building a broader lexicon and being able to figure out what words mean the precise thing they are intending to say.

While many participants admitted they were innately curious before going to university, their formal education had made them even more so. University had trained them to ask the right questions and find answers in the workplace. As one participant said, "the value is having a process and be critical of that process, find additional paths, develop opinions and ideas, and question things".

Despite the skill-set participants may have brought with them from college, many of the participants in our sessions felt like they were still in an "adapt or die" period of transition. Graduates discovered that the competencies they gained and used at university were limited, and they explained a need to learn the culture and practices of the new information landscape. Participants reported feeling "confused", "distracted" and "scared"; furthermore, if they did not acculturate then they expressed fear of failure, or, at worst, getting fired. One participant admitted, "I'm constantly at the bottom of the learning curve".

One source of anxiety stemmed from the realization that the course-related research they had done as undergraduates had much less to do with workplace research than they had initially expected. As one participant explained:

My job feels like there's a perpetual thesis due, but my job is literally about finding information that does not exist. My information needs have changed and intensified since when I was an undergraduate.

Moreover, like previous researchers in this area, we found the social side of research mattered far more in the workplace setting than it had in university. In the words of one participant, "the biggest hurdle for me was getting used to

talking to strangers". Participants most frequently discussed three challenges, all related specifically to their abilities to solve information problems in the workplace:

1. an increased sense of urgency permeates the workplace;
2. research tasks are assigned with little structure or direction;
3. information seeking and use is highly contextual and fundamentally social.

Two of these challenges mirror those described by employers in their observations of the struggles of new recruits: workplace research is often social and ambiguously defined. But graduates' perceptions of urgency seem at odds with employers' requirement they conduct research with more thoroughness, variety, and iteration.

The findings from our sessions suggest graduates recognize early on that they must alter their information-seeking behaviour to fit the cultures and demands of their new workplace environments. Most participants said they relied on two types of sources to solve these kinds of information problems: many said they jumped online first and used a search engine, while others said they consulted a co-worker.

4.4 The competency gap: graduates' coping strategies

Graduates in our focus groups frequently discussed their anxieties in getting up to speed in the workplace. Most participants discussed a set of adaptive strategies they had developed for closing the competency gap, either through formal channels, such as training or mentoring, or on their own, through "intuition" and "trial-and-error".

Even though techniques varied among the participants, there was a common thread in our discussions: the adaptive strategies many participants discussed involved *the cultivation of social capital in the workplace*. Sociologists use the term, social capital, in multiple ways to discuss a range of various situations. Still, most sociologists hold that social networks, whether actual or virtual, have value – no matter why a group of individuals may be formed or to what ends it may be used (Bourdieu and Wacquant, 1992; Coleman, 1988). In our study, we found graduates acquired social capital – developed relationships with co-workers in the workplace – so that the new recruits could build a knowledge base for increasing productivity and learning work practices and expectations in their new surroundings.

Notably, we discovered very few participants went so far as to collaborate with multiple team members. As such, the optimal skill that employers in our interviews said they needed most – approaching team members and iterating through information problem solving with the group – appeared to be a strategy few participants discussed using. Instead, our findings suggest that graduates may use social capital in the workplace one co-worker at a time.

For instance, some participants relied more on their supervisors than on online searches when they needed to "protect" themselves and / or save time, since it was "the fastest way" to solve information problems. As one participant said:

My approach is to always get stuff done as quickly as possible, so I have a habit as soon as something comes up I call the boss – just get it done as fast as possible, instead of taking time by myself to look up an answer, I'll try to figure out the fastest way to do this.

Participants also said they turned to a trusted co-worker for contextualized information. This strategy was particularly helpful for learning terminology and certain work processes, especially for participants working in a field other than their degree subject. Participants expressed pleasant surprise upon discovering that human-mediated sources trumped a Web search time and time again.

To a lesser extent, other participants relied on a two-step strategy – checking online first for background and then engaging a co-worker. These participants said they needed to "feel confident" before asking questions. Lastly, there were other participants who used computers and networked knowledge as a way of reaching out to experts via online forums, especially when tackling technical problems:

I'm sure everyone around this table knows to just Google it, if you can't find anyone to answer your question at work, there has to be someone somewhere who must have answered that question before. When you're expected to troubleshoot something and the path you were supposed to take was calling the institutional help desk that handles 11,000 people at the hospital where I work and you could be on hold forever – so I just figure out something easy to get what I need.

Despite graduates' efforts to develop new strategies, the employers that we interviewed expected graduates to develop and use social networks with many stakeholders – not just one trusted co-worker at a time. Employers in our sample were disappointed that many of today's graduates came to the workplace unprepared to sit down with and engage members of a collaborative team during the research process. If new recruits did this more readily they might find themselves in a better position to solve the messy problems of the workplace.

But, then again, this required graduates to venture into "moving off the script" and "imagining all the possible answers out there" – something few did. The qualitative data we have collected describe how new recruits may take the first steps toward learning necessary information competencies on the job – and how far they may still need to go, even if on the right track.

5 Discussion

For years there has been discussion in the library literature claiming information literacy is difficult to operationalize and measure beyond the world of the academic library (Bawden, 2001; Bruce, 1997; Hepworth and Smith, 2008; Mutch, 1997; Sokoloff, 2012). Yet, in our study, when we asked employers and recent graduates in our sample to discuss the process of *solving information problems* or *research* in the workplace, we found the phrases resonated with both groups.

There are two possible explanations for this outcome. One explanation may be that the great majority of the organizations in our employer sample are "information industries", i.e. they are primarily involved in the creation, production, and/or dissemination of information.

Another related explanation is that *information work* has become an identifiable and fundamental component of more jobs, whether one works in a cubicle, a restaurant, or a hospital. This phenomenon has proliferated with the use mobile technologies including smartphones and cloud computing (Fidelman, 2012). Finding, evaluating, and synthesizing published information had become a more frequent necessity for paraprofessional workers, such as the nurses, web designers, and waiters in our sample of graduates, as well as the rookie reporters and accountants described by employers.

In the broader sense, our findings suggest the information landscape has shifted. The workplace described in some of the literature that emphasizes social, embodied, and tacit information practices may be expanding to include workers of all types using digital and textual sources associated with "white collar" professions (Lloyd, 2005; Crawford and Irving, 2009). An expanded information landscape, while still very reliant on social information practices, may have made "solving information problems" a more easily identifiable task when we asked about these tasks during our interviews and focus group discussions.

As such, the employers we interviewed from a variety of different kinds of organizations were able to define "optimal" information competencies from their point of need with some ease as well as detail. Further, we found these skills employed both technological and social competencies, the use of online and offline sources. These findings lead us to conclude workplace information competencies for today require the ability to locate information in multiple formats and synthesize diverse viewpoints, by taking a flexible, critical, and iterative approach to solving workplace information problems.

Ultimately, our findings substantiate and build on the NACE 2011 survey results: employers highly value the ability to obtain and process information – but they tell us more. Most notably, because we present findings from both the employer and recent college graduate perspective about solving information problems across a variety of industries and occupations, we are able to identify competency-gaps between graduate information solving skills and those required in the evolving, information-intensive workplaces.

This approach yields valuable insights for both educators and employers about the challenges, preparedness, and adaptive strategies of graduates in the workplace. For example, graduates rarely engage in iterative, social information searches, preferring to rely on a trusted colleague or supervisor to find the 'right' answer as quickly as possible. In addition, although graduates demonstrate considerable competency in finding information online, their habits tend to include using information found only online; the ability to also draw from non-digitized sources – and to synthesize multiple sources – is, in the employers' view, lacking.

5.1 From campus to the workplace

The social nature of workplace information literacy has been conceptualized in a variety of ways in workplace information literacy literature, and is often explicitly contrasted with educational information literacy. For example, non-academic staff in a university valued "social networking" for gathering information (Hepworth and Smith, 2008). Lloyd (2005) described information seeking by firefighters as

the use of "embodied" knowledge, calling it a "different truth" that disrupts the traditional academic information literacy discourse. Crawford and Irving (2009) emphasized the "primacy of human contact" for workplace learning, always preferred over textual or digital sources.

Our findings provide a different, though related perspective. They enable us to differentiate the use of social research strategies as described by employers versus new graduates in our study. These social research strategies, as defined by employers in our study, relate to the iterative nature of workplace information behaviour described by Cheuk (2008). That is, employers we interviewed considered online searching competencies fundamental and hired graduates for their creative use of technology for both search and synthesis.

But employers also expected new recruits to reach out and enlist more experienced colleagues to help them synthesize and contextualize the information they had found and to guide them with further research. This finding contrasts with what Hepworth and Smith (2008) found in their study. In their research, senior staff reported it was their responsibility to reach out and mentor junior staff with accessing, using, communicating, and managing information – not the other way, as we found in our study.

Where we explore new territory is with findings from the graduate focus groups. These graduates, relatively new to the workplace, appeared reluctant to engage team members. Instead, they reportedly relied on technology to address information problems. These sessions provide a view into the differences in information problem contexts between university and the workplace.

In addition, two other major differences emerged: (1) the pace of work, and (2) the amount of ambiguity involved with solving information problems. Many recent graduates in our sessions noted their information seeking was driven by an urgent pace that was foreign to them. Graduates thought that the pace of the workplace was faster and less predictable than the academic calendar. For example, workplace research 'assignments' could change at a moment's notice as allocation of resources changed, team members came and went, and external factors impacted the way in which an organization made decisions. This perception of a more rapid-paced and ambiguous information environment complements prior research (Hepworth and Smith, 2008), in which study participants complained of a lack of time for tackling information tasks and described anxiety related to keeping up with professional developments.

Accordingly, graduates in our sessions responded to the constraints of their new setting either by jumping online to do a Google search or asking a nearby co-worker for answers to information problems. Our findings suggest graduates adopted these strategies because they wanted to prove to employers they were hyper-responsive and capable of solving information problems in an instant – a response they perceived employers wanted from them.

The findings illustrate the different mindsets both employers and graduates may bring to solving information problems. In other words, employers would like graduates to be comprehensive researchers but often make hiring decisions based on a cursory assessment of an applicant's information-seeking skills. Some

employers said they naturally assumed most college graduates they interviewed were already good researchers. After all, the recruits had made it through university, completed a myriad of assignments, and had obtained respectable marks. Graduates, in turn, presumed that they had been hired for their ability to find information quickly with the computer skills that had often got their foot in the door.

Focus group members described a second difference between university and the workplace. Graduates said they received little guidance from employers about research expectations, leading to increased ambiguity in addressing information problems. As students, they had received explicit instructions with their assignments; as one graduate explained, "You're guided to a resource and an answer they want you to find. At work, they expect you to find it. No direction." Workplace information problems offered few templates or guidance for solutions.

This finding, coupled with the increased time pressure graduates experienced in the workplace, is significant in explaining why so many graduates in our sessions appeared to assume any question could be answered as soon as possible with one 'right' source of information. In contrast, employers in our interviews needed and expected newcomers to make 'reflective judgements' – to construct knowledge and new interpretations from all the different answers they had found (King, n.d.; King and Kitchener, 2012).

Taken together, our findings form the basis for a preliminary model comparing workplace information literacy and educational information literacy. Figure 1 shows an illustrative depiction of the differences between each setting regarding the fulfilment of information tasks.

		Ambiguity	
		Low	High
Time Pressure	High	Routine university assignments, e.g. homework problem sets, assigned readings.	Workplace information tasks, e.g. competitor research, process workarounds.
	Low	Long-term university coursework projects, e.g. term papers, research presentations.	Workplace knowledge acquisition, e.g. gaining 'situational competency', learning 'gut feeling' judgement.

Figure 1: Information practices at university and at work.

As Figure 1 indicates, there is an essential difference in the information practices between university and workplace research. When they were students, many of the participants in our sessions said they relied on the printed word (either online or a hard copy) for information, and worked alone to complete assignments and meet their individual learning goals. Yet when they entered the workplace they were required to use social means for extracting and creating contextualized information and to work in collaboration to achieve the goals of an organization.

This comparison reveals the difficulties that today's university students face and the information competencies and strategies that they adopt and develop as they move from one complex information landscape to another. Further, our findings help to explain why graduates are often as surprised by the information competencies that they need, as their employers are by the practices that most new recruits fail to bring with them to the workplace.

5.2 Opportunities for academic librarians

There are limitations to our study, given its exploratory nature, the size of samples used, and the inherent problem of self-reporting in qualitative research. Nonetheless, our findings may be a good basis for making recommendations for academic librarians. In fact, our findings lead us to conclude more preparation for conducting workplace research could – and should – begin before graduation.

Academic librarians play a critical role in helping students succeed in the complex information environment of higher education, even though most students will spend only a few years in this setting. In order to help students succeed beyond the academy, librarians must embrace a multifaceted approach to teaching information literacy to increase the transferability and relevance of competencies to the workplace and lifelong learning. To that end, we offer university instructors and academic librarians five recommendations that might better prepare today's university students for solving information problems in the workplace.

1. **Reconfigure team-based assignments.** Teamwork has become more prevalent in course assignments in recent decades, but according to employers recent graduates are not comfortable conducting collaborative research. A possible explanation may lie in the fact that undergraduate project groups are made up of a set number of student peers, while workplace teams include more experienced colleagues, even supervisors. Furthermore, in the workplace one must often identify and seek out an expert as a new information-need arises. Research assignments could include more 'team-oriented scaffolding', such as small group brainstorming or discussion questions. Students could be encouraged to meet in groups with seasoned advisors, such as subject-specialist librarians.

2. **Revise library reference services.** The emerging consultation model of reference may be a better approximation of the workplace research environment. Traditional library reference service could be viewed as encouraging students to use people as sources. Yet, the drop-in reference desk, staffed by an information arbiter and generalist, is not found in most workplaces. In a scheduled consultation, by contrast, academic librarians can address higher-level competencies such as refining research questions and iterative, contextual exploration of sources. In this way, they can function as informal and occasional members of a student's research team.

3. **Work with academic staff to develop research assignments that include the use of people as sources.** To fill the competency gaps identified by this study, instruction librarians could focus additional effort on those ACRL learning

outcomes that emphasize the social components of research.[3] For example, instruction librarians can teach undergraduates how to identify a needed expertise and locate potential experts.

4. **Incorporate social media into research assignments.** Instructors can set up online social spaces for project teams to brainstorm, plan, share sources, and synthesize work. There is no shortage of free tools for collaborative research work: Zotero, Mendeley, Google Docs, and Diigo are popular and robust. These tools make the iterative nature of research more explicit and transparent. Annotated bibliographies posted on the Zotero cloud show the contributions of each team member; peer review of paper drafts can be submitted via Google Docs.

5. **Go beyond coursework.** One final solution emerged from the graduate focus groups, in which a participant described the value of managing a performing group on campus, which included a variety of challenging research tasks. Increased participation in such extracurricular activities may expose 'near graduates' to the multifaceted challenges that they can expect to find in the workplace. Academic librarians could explore outreach to extracurricular groups to strengthen the information literacy learning opportunities already present in these activities.

6 Conclusion

This study evaluated employers' needs related to workplace information work, as well as college graduates' perceptions of their research skills in the workplace. We described four primary information work strategies valued by employers, and identified competency gaps that prevented graduates from employing these optimal strategies:

1. Employers valued the act of engaging team members during the research process, but found graduates were reluctant to iterate through solutions by involving multiple, experienced team members. Graduates confirmed this observation in the focus groups, describing less diverse, one-on-one relationships with mentors and managers to solve acute information problems.

2. Information problems in the workplace often call for retrieving information using a variety of formats. Although graduates demonstrated a high level of skill in searching the internet, employers found new recruits were less likely to use other sources, such as offline documentation, specialized databases, and sources of tacit knowledge within their organizations.

3. Successful workplace research requires finding patterns and making connections among concepts and information sources. Employers described effective application of such synthesizing skills as "exceptional" among new recruits; and graduates expressed a frustration with making sense of information

[3]We identified 14 of 87 ACRL information literacy learning outcomes that are primarily social, including 1.1.a, 2.3.c, 2.3.d, 3.6 (all outcomes), 4.3 (all outcomes), 5.1.a, 5.1.b, 5.1.c, 5.2.a. (ACRL, 2000).

problems in the context of increased time pressure and increased task ambiguity versus the undergraduate environment.

4. Employers expected new recruits to explore a topic thoroughly upon being presented with an information problem. Instead, employers found graduates lacked both patience and persistence in engaging with a research topic, and were eager to find the one "right" answer, rather than approaching information work as a solid base for building personal knowledge in the workplace.

Studying workplace information literacy from both the employers' and graduates' perspective adds richness to understanding the transition from the information landscape of college to the workplace. Additional research about the relationship between these perspectives has the potential to lend more understanding to workplace information literacy.

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