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Just Curious: How Can Academic Libraries Incite Curiosity to Promote Science Literacy?

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Abstract

Based on a *Bright Young Minds* webinar given on February 7, 2017, this paper shows the importance of nurturing curiosity in students as an integral part of information literacy (IL) and science literacy. There are obvious parallels between "Research as Inquiry," as described in the *ACRL Framework for Information Literacy for Higher Education* (2016) and scientific inquiry. In both cases, curiosity is the fuel that drives information gathering and the pursuit of new knowledge. This paper discusses three pedagogical strategies to help information literacy librarians incite curiosity in students and promote scientific literacy.

Bright Young Minds is a webinar series hosted by the Ontario Library Association's Education Institute. It provides a platform for MLIS students and recent graduates to share their research and to foster connections between academic schools and information professionals.

The webinar and this subsequent article grew out of an MLIS project exploring the concept of curiosity and its application in promoting scientific literacy in academic libraries. I draw on my dual experiences as both a Chemistry graduate student and participant in IL sessions, and as a recent MLIS graduate and IL instructor.

Curiosity as the Driving Force of Science Literacy

In an article published in *Educational Leadership*, Hurd (1958) defined scientific literacy as an understanding of science along with its social implications, and made a clear connection between scientific literacy and informed citizenship. The American Association for the Advancement of Science (1989) further advocated that science literacy is a systematic application of curiosity. In identifying the calls to transform the curriculum from the information literacy (IL) perspective, Hensley (2004) demonstrated how curiosity fits within the context of individuality and intellect, and argued that it is vital to incorporate curiosity into the teaching and learning of IL. More recently, Rempel and Deitering (2017) discussed how curiosity could inspire instructional strategies to help learners see the research process in a new light.

We're all born curious, and countless scientific discoveries, artistic achievements and social developments attest to our "hunger for knowledge." Labelled as the "fourth drive" (behind hunger, sexual desire, and the need for shelter) by freelance journalist and author Ian Leslie (2014, p. IX), curiosity is the key motivating factor for inquiry-based learning. Bridging the domains of science literacy and information literacy, curiosity drives information seeking and helps promote lifelong learning.

What Is Curiosity?

Aristotle described human curiosity as a "desire to know" (c.350 B.C./1941, p. 689). From Aristotle's perspective, curiosity was seen as an *intrinsically* motivated pursuit of knowledge for the sake of knowing. Although the concept of curiosity was discussed throughout history, it was not until the early 1950s when Daniel E. Berlyne applied empirical evidence to the development of a formal theory of curiosity. Berlyne (1960) viewed curiosity as *externally* stimulated and identified some of the elements that would incite curiosity such as novelty, surprise, complexity, and incongruity. Overall, it is the desire to reduce the sense of curiosity that triggers the exploration and information-seeking behaviour.

The literature on curiosity spans several fields including psychology, education, and neuroscience. According to behavioural economist George Loewenstein (1994) however, the underlying cause of curiosity, whether someone's curiosity is intrinsically motivated or externally stimulated, is inherently unanswerable. Loewenstein proposed a contemporary view of curiosity with an information-gap perspective that reflects a human need for sense-making, which is relevant to librarians' interest in information behaviour.

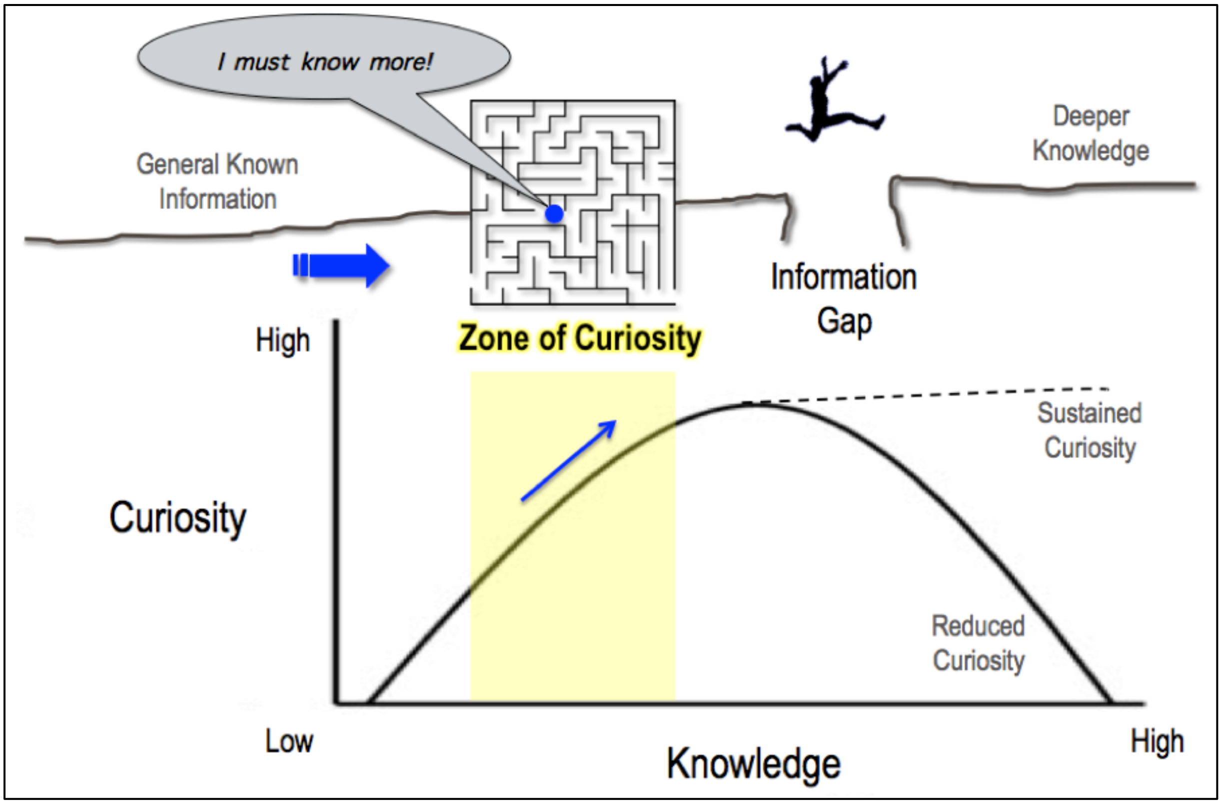

Figure 1. Loewenstein's information-gap perspective of curiosity (p. 89)

From this information-gap perspective, curiosity is positively related to a learner's knowledge in a particular domain. At first, the learner is likely to focus on what information he or she possesses. As one gains information about the topic, the likelihood of the learner shifting focus to what information he or she is *missing* increases (see Figure 1). This shift of attention is the genesis of curiosity according to Loewenstein (1994, p. 89), because it is then that the individual becomes aware of his or her information gap. The intensity of curiosity is positively correlated to the individual's ability to close that gap. This suggests that without an existing knowledge base, curiosity is unlikely to arise. Meanwhile, curiosity should increase as the individual further delves into a topic, at least within the "zone of curiosity" (Anderson, 2011, p. 81) where exploration takes place. Once a certain degree of deeper knowledge is attained, the sense of curiosity would either be sustained or reduced depending on circumstances and the learning aptitude of the individual.

The Parallel between Science as Inquiry and Research as Inquiry within The ACRL Framework

Inquiry has been an explicit goal of science education for more than 50 years (Bybee, 2010; Bybee & DeBoer, 1994; Chiappetta, 2008). As suggested by Loewenstein's information-gap perspective discussed above, "scientific inquiry is almost never unscaffolded, but proceeds on the basis of prior knowledge" (Hoveid & Gray, 2013, p. 15). As the term *inquiry* implies, questions are fundamental to both scientific research and problem-based learning. Science as inquiry is a method of thinking and an "attitude of mind" (Dewey, 1910, p. 121). It is a dynamic, learner-centered *process* because ultimately, the students have to come up with their own questions.

Borne out of the rapidly changing higher education environment, the uncertainty of the information landscape, and the belief that IL holds the key to academic success, the Association of College and Research Libraries developed its *Framework for Information Literacy for Higher Education* (ACRL, 2016). Under its "Research as Inquiry" threshold concept, the *ACRL Framework* identifies intellectual curiosity as one of the learner dispositions, where learners would "formulate questions for research based on *information gaps* [emphasis added] or on re-examination of existing, possibly conflicting, information" (ACRL, 2016). Promoting scientific literacy via the science-as-inquiry approach is outcome-focused and contextualizes the ACRL's information literacy framework as a meaningful endeavour. More than just a set of skills, information literacy is an attitude that reflects an interest in seeking information. By encouraging the pursuit of new knowledge, curiosity helps situate scientific research on a personal level and stimulate inquiry through the actionable process of problem-solving.

Three Curiosity-driven Pedagogies for Scientific Literacy

1. Reflection through "Bad Science"

"Pulling bad science apart is the best teaching gimmick I know for explaining how good science works," asserted *The Guardian* science blogger Ben Goldacre (2011), whose *Bad Science* blog covered anything from biases in clinical trials for drugs to data manipulation in science reporting. By inciting curiosity through reflection and discussion about Goldacre's blog in her IL sessions, Riehle (2012) engaged students in learning about information evaluation in the real-life context of the scientific publication cycle. Through purposeful exploration of self-selected blog postings, the students got the opportunity to develop their own inquiries, synthesize personal meanings, and draw individual conclusions in the context of science communication and information resources in general. Riehle argued that information should not be merely evaluated against a checklist of accuracy, authority, currency, objectivity, and coverage, and that the role of a teacher is "not to impart knowledge, but to facilitate dialogue, to prompt, and to challenge" (2012, p. 229). Building on the reflective writing of students, later follow-up assignments featured debates that required students to find primary sources to support their arguments. Overall, the students were found to select higher quality and more appropriate references compared to previous semesters.

2. Science Café

The term Science Café refers to

> events in informal settings, such as coffee shops, pubs, restaurants, and other public places, in which laypeople interact face-to-face with scientists. These Cafés are part of a broader movement that aims to engage nonscientists in

> dialogues—and sometimes decision making—about science and technology developments. (Powell, 2010)

While any scientific and technological topics can be covered in a Science Café, the interests of the communities and local contexts are usually taken into account. With dialogue itself as the main goal, scientists are encouraged to use plain language and interactive presentation styles to facilitate discussions. Numerous Science Cafés have been organized by Canadian universities (Carleton University, n.d.; Navid & Einsiedel, 2012; Science North, n.d.; University of Windsor, n.d.) and the Canadian Institutes of Health Research (Government of Canada, 2015 and 2016) as one of their outreach strategies.

From my dual experience as an IL session participant and instructor, students may come with a general topic in mind but struggle to narrow the scope of their topic to a manageable research question. Library workshops, however, have tended to focus on finding the best databases and keywords, with the emphasis on controlled vocabularies and Boolean operators. Since the students have yet to figure out their research questions, no wonder they do not fully appreciate IL sessions. Research is an iterative process. Instead of "teaching the tool," the need to help students ask better questions should be addressed as a priority. In developing a Science Café program at the California Polytechnic State University Library, Scaramozzino and Trujillo (2010) found that curiosity was one of the top three reasons why attendees attended a Science Café, and recommended creating opportunities for student speakers to boost student participation. To help students work out their research questions, libraries could organize Science Cafés that featured senior graduate students, where part of the content and conversation at the event would showcase how and why their research questions were formulated. Aligned with the *ACRL Framework* of "Scholarship as Conversation" (2016), Science Café also encourages mentorship and peer learning.

3. Integrated Science Program (iSci)

According to the *ACRL Framework*, in order to be effective, information literacy has to be integrated with curriculum content, structure, and sequence (2016). The Honours Integrated Science Program (iSci) offered by the Faculty of Science at McMaster University meets this criterion. With its first cohort in 2009 and an enrollment limit of 60 students per year, a major component of the interdisciplinary, four-year undergraduate program centers on self-directed, inquiry-based and project-oriented learning (Colgoni & Eyles, 2010; McMaster University, n.d. a). In its program structure essential knowledge and skills from the core scientific disciplines such as life sciences, chemistry, and physics are linked through interconnected thematic modules (McMaster University, n.d. b). The iSci program is staffed with an embedded Services Librarian. From IL sessions to learning space accommodation, the involvement of a dedicated librarian "allows students to appreciate the importance of library and information science and its links to overall, effective scientific communication" (Colgoni & Eyles, 2010, p. 11).

According to the Services Librarian, Andrew Colgoni, the science literacy portion is fully integrated into the curriculum and co-taught with a faculty member. It has its own share of grades allocated throughout the program alongside with the other science core subjects. In Year 1, the weekly two-hour science literacy sessions introduce students to different forms of science communication such as blogging, debate and poster presentation (personal communication, July 27, 2016). By scaffolding the research skills and ethics critical to future project deliverables, the information literacy and evaluation are contextualized and curiosity-driven. In the upper years, the program becomes progressively more self-directed while the IL component becomes more personalized. This “choose-your-own-adventure” model allows students to participate in a variety of science communication endeavours, including a student peer-reviewed journal and student-run, end-of-year symposium, which are evaluated holistically by a team of faculty members depending on subject areas of focus as well as by the Services Librarian on their IL merits (McMaster University, n.d. c). Overall, the students were very satisfied with the opportunities for receiving feedback in iSci courses compared to non-iSci courses (Symons et al., 2012). A longitudinal study has been put in place to survey alumni at one, three, and five years post-graduation to determine whether the science literacy component prepares them for the career they eventually choose.

Conclusion

Inquiry-based learning, with the emphasis on the “why” rather than the “how,” fosters individual curiosity and encourages knowledge creation based on a deeper personal connection. Information literacy is not only about how to find, use, and evaluate information: it is about navigating this complex world of information through personal inquiry and critical thinking. Well-designed and curiosity-driven IL sessions that are curriculum-integrated contextualize student learning, thereby making the sessions just-in-time as opposed to just-in-case. When asked about the challenges in differentiating between science literacy from information literacy, Colgoni asserted that “[i]nformation literacy rarely is something that stands alone. ….By and large, it’s about *application to* [emphasis added] research, and science communication effectively blurs the line between what it means to be teaching both” (personal communication, July 27, 2016).

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