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Identifying Threshold Concepts for Information Literacy: A Delphi Study

Lori Townsend
University of New Mexico, University Libraries, lt@unm.edu

Amy R. Hofer
Linn-Benton Community College, hofera@linnbenton.edu

Silvia Lin Hanick
LaGuardia Community College (CUNY), slinhanick@lagcc.cuny.edu

Korey Brunetti
Desert Regional Medical Center, korey.brunetti@csueastbay.edu

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Lori Townsend
University of New Mexico

Amy R. Hofer
Linn-Benton Community College

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LaGuardia Community College (CUNY)

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Desert Regional Medical Center

This study used the Delphi method to engage expert practitioners on the topic of threshold concepts—core ideas and processes in a discipline that students need to grasp in order to progress in their learning, but that are often unspoken or unrecognized by expert practitioners—for information literacy. A panel of experts considered two questions: First, is the threshold concept approach useful for information literacy instruction? The panel unanimously agreed that the threshold concept approach holds potential for information literacy instruction. Second, what are the threshold concepts for information literacy instruction? The panel proposed and discussed over 50 potential threshold concepts, finally settling on six information literacy threshold concepts.

Communications in INFORMATION LITERACY

INTRODUCTION

The oracle at Delphi was a bit like a reference librarian, albeit with goat sacrifices, trance-induced possession, and a much fancier desk. She fielded tough questions from kings and commoners alike, all of whom sought her ability to channel Apollo and reveal the future. Like any psychic—or librarian—worth her salt, the oracle's advice was open to interpretation, but she always did her best to answer the question. This study seeks the wisdom of our own oracles, those prominent voices in our field, to help us determine the potential of threshold concepts for information literacy.

Threshold concepts are one way to approach the core concepts in our discipline. They are an exciting approach to re-engaging with teaching content because they offer a unique perspective by which to prioritize disciplinary knowledge. While the idea of threshold concepts has entered the national discourse about information literacy instruction via ACRL's new Framework for Information Literacy for Higher Education (ACRL, 2014), it remains an emerging theory, both broadly speaking and with respect to our discipline. As practice-oriented professionals, librarians are very interested in producing reusable materials that incorporate threshold concepts into instruction sessions, syllabi, and course materials. Using the Delphi method, a qualitative approach in which a small group of experts anonymously answer questions in writing, this study's goal is to come to confident conclusions about the theoretical underpinnings of the materials we would eventually like to produce and share.

This study invited expert practitioners to answer two questions. First, are threshold concepts useful for information literacy? The short answer to this question was yes; the in-depth results from the discussion that emerged over this question will be addressed in a separate publication. This paper addresses a second question: What are the threshold concepts for information literacy?

LITERATURE REVIEW

Threshold Concepts

Threshold concepts—an approach to teaching and learning developed by Jan Meyer and Ray Land, British educators working on a project called Enhancing Teaching–Learning Environments in Undergraduate Courses—are core ideas and processes in a discipline that students need to grasp in order to progress in their learning, but that are often unspoken or unrecognized by expert practitioners. As described by Meyer and Land, threshold concepts have five definitional criteria:

- Transformative: cause the learner to experience a shift in perspective;
- Integrative: bring together separate concepts (often identified as learning objectives or competencies) into a unified whole;
- Irreversible: once grasped, cannot be un-grasped;
- Bounded: may help define the boundaries of a particular discipline, are perhaps unique to the discipline;
- Troublesome: usually difficult or counterintuitive ideas that can cause students to hit a roadblock in

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their learning (Meyer & Land, 2003).

Since this model was developed, Meyer and Land have published several books exploring threshold concept theory and its applications in a wide variety of disciplines and learning settings (Meyer & Land, 2006; Land, Meyer, & Smith, 2008; Meyer, Land, & Baillie, 2010). A biennial conference in the UK has served to further develop a community of practice and spread new thinking in this area. Mick Flanagan maintains a bibliography on threshold concept publications (Flanagan, 2014).

At the same time, threshold concepts may be understood as a repackaging of many other current educational theories, and have been shown to work well in tandem with them. For example, Lundstrom, Fagerheim, & Benson (2014) used threshold concepts in combination with Decoding the Disciplines (Middendorf & Pace, 2004) and backward design (Wiggins & McTighe, 2005) in order to revise learning outcomes for information literacy in composition courses at Utah State University. This flexible approach to theory captures a point that researcher Glynis Cousin makes: "There are clear overlaps and affinities with a number of the ideas shared by the theory of threshold concepts and other perspectives in education" (2008, p. 261). Threshold concepts may be understood as a shortcut through the theories for disciplinary faculty who do not hold advanced degrees in education (Meyer & Land, 2007).

Not surprisingly, with greater dissemination and the increase of discourse on the topic, positions against threshold concepts have emerged. Some critics point out that

threshold concepts as a pedagogical theory are not proven to be effective per positivist methodologies, or that the criteria for establishing which concepts are threshold concepts are inexact (e.g., Rowbottom, 2007; Wilkinson, 2014). Librarians' objections often center on ACRL's use of emerging theory to underpin their new standards document (e.g., Saracevic, 2014).

Identifying Threshold Concepts

Barradell (2013), in her review of methods used to identify threshold concepts, finds that the threshold concept literature turns up a wide variety of methods used to identify threshold concepts in different disciplines: "informal, semi-structured, phenomenographic interviews…, questionnaires, surveys, short answer problems and review of old examination papers…, and observation of classroom behavior" (Barradell, 2013, p. 269). Barradell also asserts that "The conversations in which threshold concepts are discussed are recognized as being integral to the process" (2013, p. 269). Barradell concludes that consensus methodologies such as Nominal Group Technique and the Delphi method can be effectively deployed in order to obtain collaborative and structured conclusions to these discussions.

Shinners-Kennedy and Fincher (2013) spent years pursuing a multimodal research project to identify threshold concepts for computer science that included students as research subjects, in semistructured interviews, concept mapping, and journaling. Yet they conclude that their very thorough efforts resulted in an unexpected dead end, which led to a re-evaluation of their methods; in their analysis they found that both hindsight bias and a false

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hypothesis about the emotional state of a student acquiring a threshold concept made their results too limited. Where Barradell (2013) advocates strongly for including research with students in developing threshold concepts, Shinners-Kennedy and Fincher found that it was more productive to ask "Where would we look to see evidence of threshold concepts in teachers' practice, in their pedagogical *presentation* of concepts, rather than in learners' *acquisition* of them?" (p. 13). They use a content representation form developed by Loughran, Berry, and Mulhall (2006) as a concrete method of capturing instructors' expertise as situated in classroom experience. Their work supports the idea that instructors are the experts on the threshold concepts for their fields.

The Delphi method is a good fit to validate the threshold concept approach for information literacy instruction and define the threshold concepts for information literacy because threshold concepts are identified by subject experts. Delphi studies have been used in other fields to identify threshold concepts. Examples include occupational therapy (Nicola-Richmond, 2014); sustainable agriculture (Nguyen, 2012); and community service (Fuzzard & Kiley, 2013). The authors note, too, that Delphi studies have often been used by librarians and information professionals (examples may be found in Buckley, 1994; Baruchson-Arbib & Bronstein, 2002; and Feret & Marcinek, 2005). There are also many instances in the literature of using the Delphi method to research information literacy topics—in fact, a Delphi study contributed to the definition of the term "information literacy" (Doyle, 1992; Green, 2000; Neuman, 1999; Saunders, 2009;

Howze & Dalrymple, 2004; Dixon-Thomas, 2012; Secker, 2011). In a number of countries, Delphi studies have been used to guide development of information literacy standards documents at the national level (for example, Seeker & Coonan, 2012; Xiaomu, Ping, Mengli, & Weichun, 2008; Wen & Shih, 2006).

The literature strongly suggests that researchers and instructors may arrive at differing or complementary conclusions regarding the threshold concepts for a field. For example, Buehler and Zald (2013) look at learning thresholds that must be crossed by graduate students entering the scholarly conversation as authors or presenters and write that "The publication process can be identified as an information literacy 'threshold concept' with particular immediacy for graduate students" (p. 219). Kiley and Wisker's related work looks at interdisciplinary threshold concepts for graduate students learning to become researchers in their doctoral programs (2009). The equivalent threshold concept identified in their study is "knowledge creation": "Supervisors can report evidence of the contribution of new ideas and thought, and in self-motivated research that indicates not just a willingness to work but an engagement with the essential issues and the leading edge work on the field" (p. 438). These findings support the idea that there are many learning thresholds associated with information studies and information literacy.

Threshold Concepts for Information Literacy

Townsend, Brunetti, and Hofer (2011) suggest that threshold concepts can be used to prioritize teaching content for

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information literacy and to develop a reflective teaching practice. In a special issue of *Communications in Information Literacy* dedicated to the ACRL Information Literacy Standards revision, Hofer, Brunetti, and Townsend recommend that the new standards use learning theories such as threshold concepts to focus on disciplinary content in information literacy rather than procedural how-tos (2013). The revised ACRL Framework for Information Literacy for Higher Education (the Framework) looked to threshold concepts as a way to shift the profession's attention away from a checklist approach and toward underlying concepts that students need to understand in order to become information literate. Though the final draft of the Framework moved away from using this terminology, threshold concepts continue to inform the document (ACRL, 2014; author Lori Townsend was a member of the Task Force).

The profession as a whole may now be on the steep side of the learning curve when it comes to understanding threshold concepts; as Oakleaf (2014) points out, "For many librarians, threshold concepts are unfamiliar constructs, represent a different way of thinking about instruction and assessment, and require a concerted effort to integrate into practice." It is not surprising that librarians might initially struggle to integrate and apply this new approach: "The idea of a threshold concept is in itself a threshold concept" (Atherton, Hadfield, & Meyers, 2008, p. 4). The professional community has responded with a wealth of conference sessions, workshops, webinars, and other learning opportunities for librarians seeking development in the area of conceptual teaching and learning.

Well before the publication of the new Framework drafts, instruction librarians explored the area of threshold concepts for information literacy. Several works understand information literacy itself to be a learning threshold, as captured by Bent, Gannon-Leary, and Webb (2007): "We can see that to develop as an information literate person, an individual must cross a threshold in their attitude to and understanding of information in their personal research environment" (p. 84). This understanding is echoed in Yorke-Barber et al. (2008) and Rodrigues and Sedo (2008).

The authors, by contrast, understand information literacy to be a field for which there are multiple learning thresholds (Hofer, Townsend, & Brunetti, 2012); this view of information literacy is shared by others with an interest in threshold concept research. Margaret Blackmore, for instance, developed learning thresholds for information literacy by enlisting support staff at her institution to identify content that is troublesome for students (2010). In subsequent work, Blackmore and Freeland (2014) argue that information literacy should not be taught as a linear series of competencies, often limited to search strategy. They developed an assignment for undergraduates in a game design course that begins to put this approach into practice through authentic assessment.

Virginia Tucker's doctoral thesis work (2012) uses a threshold concept approach to study the differences between expert and novice searchers in order to better understand the acquisition of expertise. Tucker's work is able to look at liminal spaces because her subjects were "intent on becoming experts" (p. 3). Threshold concept

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theory is well-suited as a framework for this type of study because it makes the differences between novices and experts explicit (Tucker, 2014). Tucker's subsequent work (Tucker, Weedman, Bruce, & Edwards, 2014) further develops the potential of a threshold concept approach to LIS education.

Kiley and Wisker's work on threshold concepts for doctoral researchers (2009) raises the question of whether information literacy may have threshold concepts that are bounded by a discipline, when the learning thresholds for research are present in every discipline. Brunetti, Townsend, and Hofer (2014) argue that the interdisciplinary nature of our teaching content indicates that information literacy threshold concepts need to be grasped by the student both in order to progress in her own field and to become information literate. Nevertheless, there are common ways of thinking and practicing shared by librarians—related to our own field, information science—that represent interdisciplinary learning thresholds that students can approach and cross (Townsend, Brunetti, & Hofer, 2011).

Hofer, Townsend, and Brunetti (2012) conducted a qualitative survey in order to establish common "stuck places" for students, and to then extrapolate threshold concepts for information literacy—that is, concepts that students would need to grasp in order to get un-stuck. From this study, seven information literacy threshold concepts were proposed. Yet the study participants were so well-versed in the ACRL Information Literacy Competency Standards for Higher Education that the authors determined this shared mindset to be a significant limitation of the study. Using

the Delphi method, the present study addresses the limitations of the previous study and expands upon its findings.

METHODS

The purpose of this study was to answer two questions:

1. Is the threshold concept approach useful for information literacy?
2. What are the threshold concepts for information literacy instruction?

The Delphi Method

The Delphi method was originally developed by the RAND corporation in the 1950s to predict the future (it was named after the Greek oracle for this reason). A Delphi study is a qualitative research method in which a small group of experts are asked to anonymously answer questions about a topic in writing. It works in some ways like an extended group survey with opportunities to give feedback to others and revise individual answers. The Delphi method is not designed to generate proof for a theory backed by quantitative data. Rather, it brings a group of experts toward consensus around a given issue through an inherently qualitative process. Because threshold concepts are meant to be identified by experts in a given field, the Delphi method is a productive means by which to validate a group of proposed threshold concepts for information literacy.

Responses are collected and summarized by a moderator and then sent back to the experts. This process is called a round. In each round, experts read the responses of their peers, make adjustments to their own answers, and address questions raised

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during the previous round. In this way, influence relating to professional reputation and personal demeanor is precluded. The purpose of conducting multiple rounds is to enable the experts to approach consensus on the research question (Luo & Wildemuth, 2009). At the same time, as with other qualitative research methods, the process is just as informative as the end result: "Delphi may be seen more as a method for structuring group communication than providing definitive answers" (Charlton, 2007, p. 246).

Brian Cape's article describing how he used a Delphi study in his Information and Library Management dissertation work (2004) was especially useful in informing the present study design (discussed further in the next section). In particular, Cape notes that "The way in which the results are fed back to the respondents can affect the final outcome... Producing the feedback was therefore the first stage in data analysis" (p. 39). The authors found this to be the case; acting as moderators for material shared in each round was indeed a process of data analysis. Cape also emphasizes the importance of what he calls "member checking" of the outcomes: participants are invited to provide feedback on the results of the study, "ensur[ing] that the respondents agreed with the way in which the research had represented and interpreted their comments" (Cape, 2004, p. 45). As described below, the present study extended into an unexpected fourth round in order to check the outcomes with panelists.

Forming a Panel of Experts

Delphi study panelists are chosen based on their demonstrated expertise in the area of inquiry. For this study, panelists were chosen based on their knowledge of and active participation in the field of information literacy and library instruction, as shown through publication, teaching, or leadership in professional organizations.

An initial list of potential panelists was generated by a search of three databases: Library, Information Science & Technology Abstracts (LISTA), Library & Information Science Abstracts (LISA), and WorldCat. The search terms used were "information literacy" OR "library instruction" OR "research instruction" and the date range was limited to publications after 1995. This date range was selected in order to establish a list of experts who were likely to be currently active. The list of articles and books was exported, and authors with multiple publications or particularly well-cited, influential, or relevant publications were placed on a list. The leadership rosters of prominent organizations were also consulted, such as the ACRL Instruction Section and the IFLA Information Literacy Section. From this list, a pool of 80 potential panelists were contacted with an email invitation to participate in the Delphi study. 27 experts initially agreed to participate in the study through an online consent form, and 19 panelists participated in the first round.

Research

The present study was conducted from March 2013 to March 2014 and included:

- formation of a panel of experts;
- distribution of the Round 1 questions;
- analysis of Round 1 responses;
- distribution of Round 1 analysis and Round 2 questions to panelists;
- analysis of Round 2 responses;

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- distribution of Round 2 analysis and Round 3 questions to panelists;
- analysis of Round 3 responses & subsequent decision to continue for another round;
- distribution of Round 3 analysis and Round 4 questions to panelists; and
- analysis of Round 4 responses.

Panelists were asked to begin by reading three articles. It was assumed that panelists possessed a thorough knowledge of information literacy, but may not have previously encountered threshold concepts. Therefore, panelists were asked to read two Meyer and Land articles about threshold concepts and one article concerning threshold concepts and information literacy. Panelists were asked to consider two primary questions in each round; the research results therefore fall into two parts. Question 1 (Q1) considers the potential usefulness of a threshold concept approach to information literacy. Questions 2 and 3 (Q2 & Q3) identify and discuss information literacy threshold concepts.

Q1 of Round 1 began with a question about the viability of the threshold concepts approach for information literacy instruction, a simple yes/no question along with an invitation to discuss. Q2 of Round 1 invited feedback on a list of potential threshold concepts, and Q3 asked panelists to suggest additional threshold concepts for information literacy.

This pattern continued in all succeeding rounds. The Q1 yes/no question on the usefulness of threshold concepts for information literacy instruction was answered decisively in Round 1 with a yes,

though the discussion of related issues continued in each round. Q2 for each round always began with a list of potential threshold concepts to discuss and Q3 asked panelists to suggest additional threshold concepts. After Round 1, panelists were asked to indicate which threshold concepts seemed strongest, and a ranked list was generated based on this feedback. The list of potential information literacy threshold concepts and descriptions of those concepts was thus refined in each round based on participant feedback.

Weaknesses
The Delphi method has inherent weaknesses. The ability of the researchers to choose rather than sample for their experts affects the outcome of a Delphi study. Other limitations include the fallibility of experts, imprecision, and the bandwagon effect after the first round (Buckley, 1994).

Though panelists were selected based on routine criteria for expertise (publishing, presenting, and participation in professional organizations), the composition of the panel inevitably reflects the demographics of academic librarianship in general. Additionally, panelists may have been more likely to agree to participate in the study if they knew one of the authors personally. The authors also had to make an extra effort to include practicing librarians, as publishing metrics alone could have resulted in a panel composed solely of LIS academics.

Panelists were selected for their expertise in information literacy, as opposed to other areas of information science. Information literacy experts typically do not have the technical skills possessed by librarians

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working with digital collections, metadata, or other technical services. This lack of technical expertise may have influenced the type of threshold concepts that emerged from the study.

This study was complicated by the release of the new ACRL Framework for Information Literacy between Rounds 3 and 4 of the study. Several members of the task force were panelists in the Delphi study, and the Framework was initially based on early results from the Delphi study. Beyond this, the threshold concepts model as it relates to information literacy immediately became more prominent. The Framework may have served as an outside influence.

The researchers initially planned for the study to run for three rounds, but at the end of Round 3, it became clear that some questions were unresolved and that another round would be needed. As a result, there was a significant delay of 3 months between Rounds 3 and 4, which may have affected the final results and amplified study fatigue among panelists.

This study may also have been affected by the fact that the threshold concept model is itself a threshold concept, meaning it is difficult to understand and can take time to fully grasp. While the panelists were experts in information literacy, threshold concepts were new to some of them. Though unavoidable, this may have had an impact on the results of the study, as panelists spent time wrestling with their own understanding of the threshold concept model.

RESULTS

As described in the Methodology section,

each round asked panelists to consider two questions: Q1, concerning the potential usefulness of the threshold concepts approach for information literacy, and Q2 and Q3, identifying and evaluating proposed information literacy threshold concepts.

Q1 was quickly answered in Round 1 with a unanimous "yes": the threshold concepts approach holds potential for information literacy instruction. As described above, a detailed analysis of Q1 data will be made in a separate publication.

Q2 & Q3 explored the viability of different proposed threshold concepts. In asking panelists to suggest and evaluate threshold concepts, the authors did not specify that the proposed concepts should meet all of the five definitional criteria. The six threshold concepts that emerged in the study vary in how fully they meet each criterion.

The results presented here chart a course through a large collection of qualitative data. It is impossible to concisely relate the conversations that panelists engaged in about the various threshold concepts. However, it is these conversations that directed the development of each threshold concept. Data analysis was ongoing throughout the study in each successive round. The overall results can be presented as a linear description of this study's Delphi process. The final list of proposed threshold concepts also functions as the results of the study. A link to the study data is posted at the website http://ilthresholdconcepts.com.

Round 1
Panelists were presented with seven proposed threshold concepts and asked to comment on them. Panelists were also asked

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to propose threshold concepts of their own. Round 1 resulted in a list of 38 potential threshold concepts, including the original seven proposed by the authors, with descriptions ranging in length from a sentence to a substantial paragraph.

The commentary about all of the threshold concepts was summarized and the list of 38 potential threshold concepts with descriptions was returned to panelists for Round 2.

Round 2

Using the list of 38 potential threshold concepts generated in Round 1, panelists were asked to select the strongest and most compelling threshold concepts for information literacy. Panelists were again encouraged to suggest new potential threshold concepts.

Round 2 generated discussion of the merits of various potential threshold concepts and 15 additional proposed threshold concepts. Additionally, every time a participant included a threshold concept on his or her list of the most compelling proposed threshold concepts, it was tallied. Thus a ranked list of potential threshold concepts (Appendix A) was created based on this measure in order to track and organize panelist responses, though the rankings were not treated as formal quantitative data.

Using the data generated in Round 2—the ranked list of potential threshold concepts, the descriptions of proposed threshold concepts, and participant discussion of the various proposed threshold concepts—the authors put together a list of nine potential information literacy threshold concepts. Each potential threshold concept included a

brief description and a list of proposed concepts that the authors attempted to combine into one definition. The table in Appendix B shows how the 38 threshold concepts proposed up to this point were reduced to nine.

Round 3

Panelists were asked to respond to the proposed list of nine information literacy threshold concepts and descriptions. Panelists were again encouraged to propose new threshold concepts and suggested seven new concepts.

All participant suggestions and comments about the proposed list of nine information literacy threshold concepts were placed on a spreadsheet for consideration. Another informal ranked tally of threshold concepts was generated (Appendix C).

Based on the tally and comments, the authors combined proposed threshold concepts covering similar ground and distributed or strengthened other ideas throughout all of the threshold concepts. The list of proposed threshold concepts was subsequently shortened to six.

Round 4

The list of six proposed threshold concepts was returned to panelists for final comments. It was understood that this would be the final round. For the purposes of this study, this was "member checking," as described by Cape (2004).

The majority of comments, however, concluded that the list of threshold concepts generated in Round 3 was useful and represented some important understandings in information literacy. Remaining feedback

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was incorporated into the final descriptions of six threshold concepts.

PROPOSED INFORMATION LITERACY THRESHOLD CONCEPTS

The final results of the Delphi study are a list of proposed threshold concepts for information literacy. The following terms are used throughout the threshold concept descriptions.

The authors view *information literacy* as competence in working with systems of information to discover, evaluate, manage, and use information effectively in context, informed by an understanding of the social, political, cultural and economic dimensions that affect the creation and dissemination of information within those systems. Much like other new literacies (e.g., financial, mathematical, visual), information literacy can be understood as a facility with the foundational concepts of a given area of inquiry, in this case information science, and the ability to apply those understandings and skills in other areas of life.

Expert refers to librarians, information scientists, or others with substantial knowledge in the field of information science. Though threshold concepts represent expert understandings and practice, moving through a given set of threshold concepts does not necessarily make one an expert. *Beginners* or *novices* are people new to the field. Faculty or researchers in other disciplines are not assumed to be experts in the field of information science. Likewise, not all librarians will be conversant with all the details of the various threshold concepts, depending on their specialization within

librarianship.

Finally, one of the characteristics of threshold concepts is that they are *integrative*, and therefore, the content of the threshold concepts proposed here sometimes overlaps.

Authority
Authoritative evidence comes from sources that possess the expertise, experience, and relevant credentials to be considered trustworthy. However, those criteria are not constant across settings or situations; the disciplines have differing views of what constitutes evidence, and different situations give rise to different criteria for evaluation of authority, whether acknowledged or implicit. People create authoritative evidence as well; an information need might not be met by existing evidence. Examining the characteristics of authoritative evidence in specific contexts illuminates the systems that grant authority, including their faults, along with considerations of when, where, and why these systems are used. Understood in this way, authority is a reflection of societal structures of power.

- Transformative: The learner's understanding is transformed to a more complex understanding of authoritative evidence in which its utility shifts depending on how it is being used and the questions being answered.
- Irreversible: Experts hold a nuanced view of authority that is not conferred by simple or static markers.
- Integrative: This threshold concept helps a learner understand the format a creator may choose,

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the commercial and ethical implications of credibility, and the ways by which scholarly conversation can elevate or demote a piece of evidence.

- Troublesome: Novices may understand evidence and authority as unchangeable and can struggle to relate their own use of evidence in daily life to scholarly or professional approaches to evidence.
- Bounded: This threshold concept is not bounded by information science. However, librarians are concerned with how authority facilitates or limits the movement of information through systems of production and dissemination.

Format

Information is packaged in different formats because of how it was created and shared. Focusing on process de-emphasizes the increasingly irrelevant dichotomy between print and online sources by examining content creation in addition to how that content is delivered or experienced. While the relevance of the physical characteristics of various formats has waned with the increasing availability of digital information, understanding format in the context of the information cycle is still an essential part of evaluating information. Critical questions can be asked about content and how and why it was produced. Understanding who has access to publishing via different formats, and which voices are heard or silenced in different communication channels, reveals a great deal about power structures and privilege.

- Transformative: The learner's

understanding is transformed because understanding the pattern of events which produce information fundamentally changes the novice's view of information as a flat, undifferentiated landscape served up in a browser window. Instead, learners select information by looking to the processes and structures governing information production.

- Irreversible: Experts do not see different formats as interchangeable or identical.
- Integrative: This threshold concept brings together lessons about source selection, information evaluation, and citation.
- Troublesome: Novices may have preconceived ideas about the value of certain formats. It also may represent a language problem for beginners who are accustomed to using the word "website" to mean "I found it online" and are now asked to use a specific and narrower meaning. Finally, because the current information landscape has stripped sources of the clues that physical format used to offer, sources are increasingly difficult to categorize.
- Bounded: Format has long represented the final stage of information dissemination and has dictated much of the structure of systems for retrieval and storage.

Information Commodities

The cost of information, academic or otherwise, is often obscured. Information

may appear to be free because libraries negotiate subscriptions or interlibrary loans, institutional repositories and open-access journals do not charge for their services, and a deluge of information is brought up by a web search. Yet costs are associated with information production, and revenue may be generated as a result of its use. Understanding these realities can encourage critical thinking and resistance around the implications of the commodification of information—for example, privacy, filter bubbles, net neutrality for web content, and personal data. Considering the financial relationships involved in information production, consumption, and dissemination allows for thoughtful choices about information sources and personal data while prompting questions about the economic and proprietary influences that impact information flow.

- Transformative: The learner's understanding is transformed when the reasons behind barriers to information (such as multiple logins, embargos on current issues, or pop-up advertisements) are examined. It explains the purpose guiding academic practices such as attribution, authentication for databases, or publication expectations for faculty. The act of using information is exposed as an economic and political choice that requires care and consideration.
- Irreversible: Experts understand the value of information and do not consider any information to be unequivocally free; they also may understand the issue from the perspective of a content creator as

the author of published work.
- Integrative: This threshold concept links the academic experience to other familiar situations that involve buying and selling goods, while extending the research process beyond the classroom; this concept connects the novice researcher to a wider network of information producers: scholars, agencies, institutions, and corporations.
- Troublesome: Much of the information available to novices comes without a direct cost. Still, information is sold, bought, and requires labor to produce. Given the philosophical motives for open-access publishing, institutional repositories, open educational resources, and efforts to reduce the digital divide, this threshold concept may also introduce questions about the point at which information is not only a commodity, but also a human right.
- Bounded: Librarians have a unique perspective on the commodification of information because of our role as advocates for broad access to information and purchasers on behalf of our communities.

Information structures

Opening the hood on databases and search engines transforms them from mysterious boxes that magically produce good-enough information on command into systems that can be used precisely and efficiently. Information users leverage database features such as field searching, controlled

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vocabulary, and filtering to retrieve appropriate materials. Information creators organize information for inclusion in information systems, and also design such systems, whether managing personal information or disseminating research data for re-use. Though information structures are highly dependent upon technology, the underlying principles of organization and classification are still largely about organizing knowledge, mediated by format. Because people structure information and the systems that contain it—and human knowledge is contested, negotiated, and continually evolving—information structures often reflect economic, disciplinary, and social conventions rather than adhering to strictly logical principles of organization.

- Transformative: The learner's understanding is transformed when the structures that make information findable are explored. Questioning what content is in the database being searched complicates the idea that a single search tool can serve up all the information to meet a need.
- Irreversible: Experts structure data so that it can be reused effectively. They do not treat the search box as simple or magical.
- Integrative: This threshold concept integrates common lessons such as brainstorming keywords, Boolean operator activities, exploration of subject databases, and the value proposition of the library as opposed to web search.
- Troublesome: Novices must leave the comfort zone of their preferred

search strategy. Searching within complex information structures requires effort, patience, and persistence.
- Bounded: Librarians are trained in, care about, and often create database structures and search interfaces for information retrieval.

Research Process

Identifying and articulating useful research questions requires preexisting knowledge and is difficult intellectual work. Applying information to a problem, or using it as evidence in an argument or for inspiration in a creative endeavor, requires that the researcher understand what will qualify as disciplinary evidence. This process of inquiry, research, and use is one of iterative inquiry, allowing for mistakes and correction of earlier misapprehensions. From inquiry to seeking out existing knowledge, to the selection of relevant information, to the development and testing of a thesis/hypothesis and subsequent analysis and synthesis of the results, the process results in the creation of new knowledge. Engaging in the information creation process is an extension of the thinking process, and therefore "research" may be understood as a broadly encompassing term—though some forms of research may be more or less valued in academia.

- Transformative: The learner's understanding is transformed when research is positioned as one means by which new knowledge may be created. Research is no longer simply the retrieval and compilation of discrete facts about

a topic but is used to solve problems and answer questions both within and beyond the library.

- Irreversible: Experts are willing to work through new understandings as information is gathered and analyzed. They use these understandings to develop and refine a topic of inquiry because one of the primary purposes of research is to reach new understandings, not necessarily to confirm old ones.
- Integrative: The research process brings together the skills necessary for developing a thesis or topic and combines them with those required for finding and communicating information.
- Troublesome: Novices may think that asking questions should be easy; good questions may be perceived as springing forth whole from the creative mind. It may seem like a waste of time to do background research solely in order to get to the point of being able to ask a question.
- Bounded: This threshold concept is not bounded by information science. However, librarians are familiar with varied paths of inquiry that span across disciplines and are well positioned to offer insight on how to structure a question, where to ask it, and how to adjust a question based on new information.

Scholarly Discourse
Information users and creators are part of an ongoing conversation in which new knowledge builds upon or refutes what has gone before, and in turn inspires others. Knowledge is negotiated through ongoing discourse. In some cases, close study of existing conversations will lead to a new inquiry as a literature review reveals gaps in the conversation. In fact, scholarly discourse is most compelling when it is approached with a research question in mind. As an extension of scholarship as a conversation, scholarly conversation and knowledge creation take place in the context of a community that includes novices, apprentices, and experts. Communities uphold standards and exert influence on the content produced within those guidelines; communities may also resist new or dissenting understandings. Some communities may be difficult for certain populations to access, depending on the expectations of the community, the cost of entry, or social barriers.

- Transformative: The learner's understanding is transformed when the novice in the classroom is connected to thinkers and creators that transcend space and time.
- Irreversible: Experts do not treat their work as though it were produced in a vacuum. Read in this way, the bibliography of a scholarly paper becomes a point of access and citation has a function beyond the negative purpose of avoiding plagiarism.
- Integrative: This threshold concept reveals scholarly conventions that novices may have learned or observed to be part of an academic culture with specific (though often unspoken)

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rules.

- Troublesome: Novices may find it uncomfortable to consider knowledge as negotiated rather than fixed; they may struggle to connect their work to the broader conversations in the discipline. They have to let go of the trope of the lone genius with a light bulb over his or her head.

- Bounded: This threshold concept is not bounded by information science. Yet, libraries and associated systems of information storage and retrieval have historically been charged with providing access to the records of scholarship and cultural heritage.

DISCUSSION

Information literacy is an application of information science, and information science is an interdisciplinary field. As such, the boundaries of our discipline may be difficult to locate or may overlap with those of other disciplines. We may not be the only discipline concerned with scholarly discourse or contextual authority, but our approach to these topics is distinct. The threshold concept model also leaves room for divergent thinking about information literacy topics within the field.

Traditional bibliographic instruction positions the librarian as a supplementary source of expertise to the subject faculty and as a gatekeeper for scholarly resources. Identifying information literacy threshold concepts repositions the librarian as a subject matter expert and explicitly defines the content areas that are bounded by information literacy. As subject matter

experts with big ideas to teach, it follows that librarians need more than a 50-minute one-shot session with students. A credit course provides enough time to at least introduce students to learning thresholds, even if they might not make it all the way across the threshold in a term.

At the same time, librarians still have important procedural information to convey that can help students master the rules of the academic game. This information— bibliographic instruction—has been shown in many studies to help students succeed in higher education (for example, Cook, 2014). When it is coupled with underlying big ideas or threshold concepts, students have the chance to integrate the discrete points and gain a deeper understanding.

Because threshold concepts uncover the tacit knowledge of a discipline they can open an explicit examination of the assumptions behind the disciplinary lens that we ask students to look through. This enables instructors to acknowledge and situate their own perspectives, biases, values, and ideologies and invites students to evaluate the point of view for themselves in deciding whether to adopt it. In the case of librarians, it can help us articulate what it might mean to make "little librarians" out of our students; that is, to help them become information literate.

Encouraging students to use our disciplinary lens need not be an act of conformity or assimilation. There is room within threshold concepts to re-examine normative assumptions about the academic or information world. Because the authors have primarily worked for institutions with significant populations of underserved

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students—first-generation, nontraditional, community college, or underrepresented minorities—our stance is that threshold concepts should be used to encourage students to engage critically with the content that we teach in order to assist them in defying structural expectations. This view is consistent with the personal experiences that the authors bring to our professional lives, which are informed by the various ways in which we do not fit the presumed demographic for academics (straight, white, and male).

The threshold concepts generated by this study are not meant as a comprehensive outline of instructional content for information literacy. The authors expect that more threshold concepts will emerge as more practitioners engage with the threshold concept model. Threshold concepts will exist for specific areas of information science, such as metadata and discovery, and be articulated by librarians not traditionally associated with library instruction. While there is certainly room to expand on the present findings, the authors do believe that the threshold concepts identified by the Delphi panelists accurately describe six of the big ideas underlying the content that we teach. These threshold concepts can help a novice view information through a librarian lens.

Conclusion

As Box and Draper point out in their seminal work on model-building, "...all models are wrong; the practical question is how wrong do they have to be to not be useful" (p. 74). The threshold concepts model is imperfect and practitioner understanding of that model is likewise

flawed. However, this study collected the consensus of a group of expert practitioners and they found the model to be useful. Likewise, the authors have found the model to be useful in the real world when teaching information literacy.

Drawing upon the words of information literacy advocate Bill Badke:

> Educators are going to need to move from teaching about their disciplines to enabling their students to become disciplinarians… We must invite students into our world and there reproduce ourselves in them, turning our students into active practitioners in our disciplines. (2012, p. 93)

The purpose of this study was not to discourage librarians from teaching research skills by taking learners through library databases or subject headings. Instead, the study asked librarians to situate crucial skills within larger conceptual understandings, and to consider how we, as instructors, can reach back into the long-gone versions of our novice minds in order to show learners how to operate as practitioners in our discipline.

Authors' Note

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APPENDIX A—ROUND 1 TALLY OF PROPOSED THRESHOLD CONCEPTS

Proposed threshold concept	Endorsed as threshold concept by participant (out of 14 possible)[a]
Authority is constructed and contextual	13
Scholarship is a conversation	10
Searching is not magic	10
Format as a process	9
Information as a commodity	9
Information is socially constructed and is created and functions within existing power structures	8
The Nature of evidence is disciplinary	7
Research involves a community	7
Research answers questions	7
Research is conversation	6
Research solves problems	5
Research is a process	5
Differentiating between data, information, knowledge, and wisdom	5
"Primary source" is an exact and conditional category	5
Everything has bias	5
Student as producer of information	4
Personal belief underpins information processing	4
Absence of evidence is not evidence of absence	4
Information is not something to be gathered and learned from, but rather something that you engage with and that personally transforms in a creative learning journey	3
Deep commitment to access to information and intellectual freedom and the ability of all to have experiences of knowledge	3
Integration of sources in synthesis and creation of new information	3
Collections are organized by conventions	3
Information is created by people	3

[ARTICLE]

APPENDIX A—CONTINUED

Proposed threshold concept	Endorsed as threshold concept by participant (out of 14 possible)[a]
All categories are conditional and constructed	3
You won't find everything on Google	3
Information can be discipline-dependent	2
Information apprenticeship in community	2
Information as a political force	2
Personal profile and identity	2
There are systems at work here and you can learn to use them	2
You can't search everything the same way you search Google	2
The user and the creator	2
There are always more than two sides	1
Honesty in the information landscape	1
It's not what you say it's the way that you say it	1
Constructedness of the systems and communities and their embeddedness in political, economic, and social contexts	1

[a] 17 people responded, 3 people didn't choose specific threshold concepts, so that leaves 14 as total number possible in Column B

[ARTICLE]

APPENDIX B—ROUND 2 LIST OF PROPOSED THRESCHOLD CONCEPTS

Proposed Threshold Concept (working title)	Concepts included
Evidence changes depending on context (e.g. disciplinary)	Information is constructed for specific purposes Every resource has its use "Primary source" is an exact and conditional category The Nature of evidence is disciplinary Information can be discipline-dependent Texts will have different meanings in different social/political/ scientific and/or historical contexts
Authority is constructed and contextual	Authority is constructed and contextual
Research is a process of inquiry and creates new knowledge	Academic libraries are in knowledge creation business Research solves problems Research answers questions Research is a process Research facilitates inquiry
Searching is not magic	Searching and finding is not a linear process Metadata=Findability Good searches use database structure
You won't find everything in one place	Expert pays attention to gaps and uses multiple resources and strategies to fill gaps You won't find everything on Google You can't search everything the same way you search Google First results and initial findings are exactly that-first and initial
Format is a process	Format is a process
Information as a commodity	Once created, information is usually owned and must be used within the constraints inherent in that ownership
Scholarship is a conversation	Research is conversation Scholarship is a conversation

[ARTICLE]

APPENDIX B—CONTINUED

Proposed Threshold Concept (working title)	Concepts included
Information is socially constructed	Information is not something to be gathered and learned from, but rather something that you engage with and that personally transforms in a creative learning journey Personal profile and identity Personal belief underpins information processing Everything has bias There are always more than two sides Information is created by people Collections are organized by conventions Honesty in the information landscape Information apprenticeship in community Research involves a community Information is socially constructed and is created and functions within existing power structures Constructedness of the systems and communities and their embeddedness in political, economic, and social contexts Information as a political force All categories are conditional and constructed

[ARTICLE]

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APPENDIX C—ROUND 3 TALLY OF PROPOSED THRESHOLD CONCEPTS

Is this a threshold concept?	Yes	Maybe	No
Authority is constructed and contextual	11	1	
Evidence changes depending on context (e.g. disciplinary)	10	1	1
Format is a process	7	4	1
Information as a commodity	9	3	
Information is socially constructed	7	4	1
Research is a process of inquiry and creates new knowledge	9	2	1
Scholarship is a conversation	11	1	
Searching is not magic	9	2	1
You won't find everything in one place	5	3	4
Information apprenticeship	1		11

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