Research Methodology

1. Introduction and theoretical perspective

1.1. Overview

This review recaps the definition of metadata literacy, looks at the research approaches used to investigate information literacy and metadata, and investigates relevant avenues of research which appear to be suited for metadata literacy (ML) research. It concludes with a discussion of how the theoretical perspective and evaluative framework created in the metadata literacy literature review will be used to investigate the concept of metadata literacy.

In the previous literature review, metadata literacy was defined as "the ability to conceptualize, create, and work with metadata within information environments." Elements of metadata literacy include skills, concepts, and contexts/perspectives that are influential in supporting information tasks such as interaction, document creation, and knowledge acquisition/creation. Theories and models relevant to metadata literacy were reviewed including Bloom's taxonomy, socio-constructive literacy, extended mind theory, and a series of information theories. These theories helped inform facets of metadata literacy as detailed in the IL model proposed in the information literacy review. The purpose of this literature review is to discuss methods for investigating metadata literacy and the impact that specific metadata literacy skills have a participant's perceived information environment. Given the wide range of previously discussed theories, it is appropriate to limit investigation of the phenomenon to a particular perspective and theoretical model. For instance, ML could be examined from a social-constructionist perspective by analyzing the use of metadata in digital communities (for example Flickr, Del.icio.us, etc.). Alternately, ML could be examined through its use in a technology rich environment (for example the use of metadata and microformats by contributors/readers in Wikipedia). Alternately, ML can be researched by assessing participants' perception of the cognitive impact of metadata using the extended mind theory and the impact of metadata on their learning using Bloom's revised taxonomy. This final method could assess current levels of IL and ML and investigate their experience in metadata interactions (for example using flickr, Google or Yahoo Pipes in a metadata-rich information interaction). As the literature review on metadata literacy

concluded, using Bloom's taxonomy as an evaluative framework for these metadata tasks provides this study with a lens with which it can view participant interaction.

This methodological literature review focuses on this third perspective using the self-efficacy evaluation metric to define an approach for investigating ML. The resulting approach is partially deductive and partially inductive (Blaikie, 2000, p. 24) in that it both seeks to define ML through research and attempts to verify current states of ML in participants. This perspective can also be considered informed by the constructivist perspective (Creswell, 2003, p. 6) in its proposed use of qualitative approaches to draw out participant perspectives on the value of ML.

1.2. Theoretical perspective

This literature review is based on the overarching concept of self-efficacy research (Bandura, 1982; Kurbanoglu, Akkoyunlu, & Umay, 2006; Marcolin, Compeau, Munro, & Huff, 2000). Self-efficacy is a valid approach for assessing a technology and literacy from a participant-centric perspective. This theoretical foundation is used to inform a constructivist based research approach which emphasizes analysis of participant observations in order to inform the impact of ML on an information interaction. Because ML is an emerging concept, qualitative approaches which emphasize the centrality of participant perspective are key to discovering the roles that metadata plays in views of literacy. Conversely, quantitative methods will help evaluate participant perspectives via A self-efficacy metric.

2. Research in information literacy and metadata

2.1. Information literacy

Research of information literacy (IL) follows one of two primary themes. First, quantitative research in IL focuses on identifying trends in large populations. Second, qualitative research focuses on documenting approaches and IL practices. Information literacy is a phenomenon common to both the education and library and information science. While there are many differences in the research between these two areas, one of the key differences is the focus on primary and secondary education in the education field, and focus of the tertiary educational systems in the LIS field. Both fields employ qualitative and quantitative methods in assessing

literacy and evaluating IL models although the education field has been more successful in employing large scale quantitative studies to assess levels of IL in students (Anderson, 2008). This review of research in IL examines both qualitative and quantitative approaches across these two fields.

Anderson (2008) reviews several quantitative studies in his chapter on quantitative research in literacy including the Minnesota Computer Literacy Assessment (MCLA), the Educational Computer Competence study (ETS), the International Association for the Evaluation of Education Achievement (IEA) Computers in Education study, and the series of SITES studies (Second International Technology in Education Study) (Anderson, 2008, p. 78). He compares these studies and discusses issues related to them as a whole including lack of focus on higher education, inconsistent conceptual frameworks, lack of global vision, and focus on current technologies. In contrast, qualitative techniques are credited with being used to elicit meaning and in-depth user perspective (Kendall, 2008, p. 134). Kendal discusses the role of qualitative measures in mixed-methods approaches citing the need to fit the quantitative and qualitative approaches together properly (2008, p. 138). She suggests that techniques such as interviewing add the ability to gather contextualizing data to help inform prior quantitative research.

Information literacy research in the ILS field often focuses on small scale qualitative studies as opposed to empirical research (Tuominen, Savolainen, & Talja, 2005, p. 330). Indeed, much of the literature published on IL focuses on documenting innovative approaches, practical aspects, and personal perspectives. Tuominen, Savolainen, and Talja discuss some uncharted territory for information literacy research including "IL as a practice" or the use of IL in authentic settings, the impact of technology on IL, and the need to research the implementation of IL (2005). The call for literacy as a socio-technical practice are seen in the work of Bruce (1997) who is cited by Tuominen, Savolainen, and Talja, in which the connection between literacy and technology is discussed. On this topic, Tuominen et al. mirrors Wright (2007) who observes that technology and literacy fundamentally changed the social and political fabric of society.

In addition to assessment research articles, there are also a host of 'best-practice' articles. Valenza (2004) suggests that teachers can encourage skill development and assessment by: (a) creating research challenges, (b) evaluating works cited lists, (c) using scaffolding techniques

such as venn diagrams, pathfinders, subject specific searching, (d) collaborate with librarians, (e) asking students to annotate works cited, and (f) using formative assessment collect throughout the semester (Valenza, 2004). Finally, there are meta-reviews which investigate the application of assessment across curriculums. Hara (2006) investigated cognitive perspectives, attitude towards skill instruction, and the impact of institutional support for teaching practices.

Much of the literature reviewed here shows a focus on qualitative approaches to research. Many studies focus on theory building, model development or refinement, or perspective advocacy, all of which can follow qualitative approaches. Despite the interest in literature surrounding the socio-constructivist approaches to IL, there is little research which follows the constructivist model, emphasizing the importance of socially constructed knowledge claims (Creswell, 2003, p. 8).

Many of the approaches in IL research are qualitative in nature and include focus groups, surveys, grounded theory approaches, and Delphi studies. For example, Barziali and Zohar (2008) studied different facets of expert academic researchers including experience, discipline, and technology background and used grounded theory approach to explore the role of information in learning (p. 38). Along similar lines, Wen and Shih (2008) used a delphi study with teachers to create a list of IL standards and Lebbin (2005) investigated undergraduate student perceptions of information literacy classes using focus groups. As can be seen from these example studies, two issues in particular from our research evaluation framework come to mind. First, many of the studies follow qualitative data collection methods. There is a distinct lack of quantitative data which may help identify real trends in IL. Second, there is a highly structured concept of user classes in IL research. Studies emphasize students, teachers, experts, and novices. Often a study chose to focus on a particular type of group.

IL in the LIS field is not without structured quantitative and quantitative research however. Wopereis, Brand-Gruwel, and Vermetter (2008) studied sixteen students participating in a virtual research center which encourages in-depth research. Students were given an ‘authentic’ research question, and 1.5 hours to complete research. The study employed pre-test screening, post-test survey and a test to measure information problem solving (IPS) ability based on exposure to a specific curriculum. Wopereis, Brand-Gruwel, and Vermetter (2008) found that students exposed

to the IPS approach utilized it in their research. Likewise, Tenopir et al. (2008) used measurable approaches to identify correlation between learning styles and affective states. While they employed an open-coding approach, they also extrapolated their findings and used established methodology to interpret their results. Action based research was used to use abstracting as a way to assess students information literacy competencies (Pinto, Fernández-Ramos, & Doucet, 2008). Pinto, Fernández-Ramos, & Doucet observed that this approach allowed them to test their methodology in the classroom, that it both informed their research and teaching, etc. Action research is a popular approach in IL research, having been employed in a number of IL classrooms. One example is research conducted by Smith, Mitchell and Numbers in which approaches to IL instruction were measured through student survey (Smith, Mitchell, & Numbers, 2007). A significant criticism of action research however is that it mixes educational goals with research goals and as such may lack a clear focus.

As can be seen from the examples of structured qualitative and quantitative research, the process of conducting studies in IL in this manner requires significant coordination and background work. Further, the number of students being researched in these studies tends to be small and limited to specific classes. Just as a debate in IL literacy focuses on the need to move away from a binary view of literacy (literate vs. illiterate), there is an emphasis in the literature on qualitative research methods which do not attempt to make binary claims. Whether or not it is appropriate to take this approach in evaluating program effectiveness, concept or literacy presence/relevance, or efficacy in the use of techniques could be debated and as can be seen in the structured approaches above, attempts have been made to quantify the outcomes of IL approaches. Finally, research in IL, as in much of library and information science (LIS), rarely focuses on a single approach. In fact, Talja (1999, 2005) observes that a mixed method research which he terms contextual triangulation is more appropriate in LIS research than single method approaches. The review of IL research included in this review demonstrates that a number of approaches are appropriate.

2.2. Metadata

Metadata research has been pursued using a range of quantitative and qualitative methods, and often mixed-methods approaches. Although IL research spans a number of disciplines, metadata

research is almost entirely conducted within the LIS field, with some exploration in the field of computer science. This review of metadata research focuses on user-centered metadata research since metadata is of interest to this review as it relates to participant use. This review of research in metadata also focuses on approaches to studying the interaction between participants and metadata and identifies approaches for evaluating these interactions. The types of research reviewed include participant perspectives and the utility of metadata.

Research in the area of participant perspectives tends to employ a variety of approaches. This is likely due to the fact that a key element in studying the interaction between participant and metadata is the identification of user perspective within the context of their actions. For example, Greenberg et al. (2001) used established methods for evaluating metadata quality but also solicited metadata creator impressions via a survey. The authors used existing metadata evaluation methods and relied on expert evaluation to determine metadata quality. Similarly, Talja's (2005, p. 15) contextual triangulation approach investigates a phenomenon from multiple perspectives. His 2005 article on computer literacy employed this approach to get at the concept of the information technology self – a user-defined conception of their IT literacy state in specific contexts. Talja's (2005) approach allows research to view participants from multiple perspectives, relationships, and assumptions. In contrast, the goal of Ju's (2007) research was to detect significant differences in system use/outcomes of two classes of users (domain experts and technology experts) without paying particular attention to the cognitive/affective aspects of those classes of users. Ju (2007) used the GOMS (Goals, operators, methods, selection rules) to create a matrix of the elements to track during the interaction between user and information system.

In addition to examining participant perspectives on metadata, metadata research focuses on the utility of metadata. Hert et al. (2007, p. 1270) discuss two overall approaches to metadata research in their article on assessing the use of metadata in statistics on the web. First, they document research which investigates metadata from the perspective of relevance to a given information interaction (e.g. use of metadata in making relevance judgments on documents). Their definition of a relevance judgment study is that it investigates "how users determine the relevance, variously defined and operationalized, or potential relevance of information units" (2007, p. 1270). The second approach they mention examines an information interaction and asks how metadata can support the user, context, and information object. Some of the uses of

this research include identification of metadata to support specific tasks, identification of important metadata, and discover information about how metadata is used (2007, p. 1271). Hert et al. assert that this approach is a 'bottom-up' approach which "reverse engineers the metadata from user issues and problems" (2007, p. 1271). Hert et al. also take a multi-dimensional in their study, first by identifying metadata elements, second by studying the metadata required for a specific task, and third by examining a single activity within that task set and the process and rules employed by the users. Some studies focuses on utility of metadata through information retrieval. For example, Choo, Deltor, and Turnbull (1999) investigated how the web impacted participants' search activities. Hawking et al. (2001) and Gordon and Pathak (1999) investigated the effectiveness of different IR strategies on the web and established a framework for conducing authentic information setting research on the web. In both the participant-focused and utility-focused research reviewed in this section, qualitative and quantitative approaches were used. The research reviewed also included both user and expert supplied evaluative criteria and employed multiple collection methods including participant surveys, interaction data, and log analysis. In both the metadata and IL research, assessment of participant perspective or success proves to be difficult. The next section examines methods of assessment in these areas.

Evaluation in metadata and information literacy research which focuses on participant levels of literacy needs some method of evaluating the level of literacy or familiarity in participants. This portion of the review investigates methods for identifying participant levels of and attitudes towards literacy concepts. Koufogiannakis and Wiebe's (2006) meta-analysis of teaching methods in information literacy found a wide variety of assessment methods including both quantitative and qualitative approaches. Of the over 4000 articles initially selected articles, they were only able to identify 55 quantitative studies which met their inclusion criteria (2006, p. 6). Kourogiannakis and Wiebe also found that most studies measured cognitive outcomes as opposed to behavioral or affective outcomes. While their study was focused on identifying studies which followed experimental/quasi-experimental approaches, their observations about the nature of IL research in general are indicative of a lack of agreement about the best approaches to research IL concepts. Koufogiannakis and Wiebe (2006) categorize the IL research articles reviewed in their meta-analysis into Bloom's updated taxonomy to show at what cognitive level the studies reviewed were focused. They found that an overwhelming majority of studies focused on the first three levels (e.g. Remember, Understand, and Apply) 167 studies

versus 29 studies in the Analyze, Evaluate, and Create areas (Koufagiannakis & Weibe, 2006, p. 12). As demonstrated in the metadata literacy review, many of the concepts and tasks central to the concept of metadata literacy (tagging, data-mashups, categorization / contextualization) occur in the Analyze, Evaluate, and Create areas of Bloom's taxonomy.

Skill-based assessment is a valid means of checking levels of literacy. Pinto, Fenanadez-Ramos, and Doucet (2008) evaluate literacy through students' ability to create abstracts. Other research uses perceptions-centric assessments such as self-efficacy ratings or qualitative ratings such as value, or observed practices. Kim and Sin (2007) investigate how behaviors of undergraduates inform how and why they select resources. Lebbin (2005) investigates the extent to which students value IL instruction and Seamans (2002) investigated the foundational IL practices of new undergraduate students. Barry (1995) discusses specific challenges to researching IL within the context of technology including incomplete knowledge of variable interactions, complexity of information seeking processes, difficulty in detecting impact, difficulty in explaining use and the fact that information seeking includes a large amount of "implicit" or internalized skills which the participant uses without being aware of (1995, p. 110).

A final method of research in literacy and technology use is the observation of a specific task in a controlled environment. Eshet (2002) for example used an assignment technique to test four different areas of digital literacy. The assignments involved authentic environments and tested photo-visual literacy, reproduction literacy, lateral thinking (hypermedia), and information trust (2002). Eshet evaluated specific 'digital literacies' through a combination of task assessments (e.g. editing a work) and attitudes (e.g. asking about impressions). In contrast to these methods, self-efficacy research focuses on a mixed affective and cognitive metric to assess participant expertise. The next section of this review investigates self-efficacy as a means for evaluating metadata-literacy.

2.3. Self-efficacy as a metric

Two of the primary goals of the proposed research is to identify the extent to which participants are comfortable and how proficient they are with the concept of metadata. Self-efficacy metrics allow the measurement of comfort level in conjunction with actual knowledge about a subject. Bandura defines self-efficacy as a self-measure of one's ability to complete a task (1982).

Bandura further refines the concept of self-efficacy by observing that is the outcome of a mix of social, cognitive, and behavioral skills and impacts not only whether or not an individual can do a task but more importantly if they will choose to take on a task and how much time they will spend with it (1982, p. 123). Marcolin et al. (2000) observe that self-efficacy tends to be viewed as an outcome of competence (p. 40). The idea of self-efficacy is also at the root of Talja's (2005) concept of the IT-self. In order to strengthen claims of self-efficacy, it is preferable to use a validated IL self-efficacy tool. Two reviewed studies on self-efficacy focused on IL self-efficacy and the impact of self-efficacy on academic performance (Kurbanoglu, et al., 2006; Tella, Tella, Ayeni, & Omoba, 2007). While several self-efficacy models exist, the IL centric model by Kurbanoglu, Akkoyunlu, and Umay provides a succinct, information interaction centric tool which can be easily implemented in a research environment. As Marcolin et al. (2000) observe, self-efficacy is but one approach to measuring IL/IT skills. In fact, self-efficacy is entirely based on participant perspective and as such could be criticized for not being a true 'evaluation' of literacy but rather identification of opinion. On the other hand, information and technology literacies are varied and difficult to evaluate using rigid evaluation instruments. Kurbanoglu et al. (2006) observe that self-efficacy is an important metric because it is a required element of an information literate person (p. 731).

Despite the value of self-efficacy research, it can also be claimed that participant confidence and self-efficacy is context dependent. This means that a self-efficacy needs to be appropriately tied to a context as closely as possible. For example, in Marcolin et al.'s (2000) work, specific self-efficacy methods were chosen which evaluated participants' feeling about being able to complete specific tasks. Likewise, Kurbanoglu et al. (2006) observe that a specific IL self-efficacy test is required. The self-efficacy test developed by Kurbanoglu et al. focuses almost entirely on skills. Given this fact, it may be necessary to develop a self-efficacy test centered on the concept of metadata literacy. This is no small task as Kurbanoglu et al. report. As noted above, creating a context specific self-efficacy test is important in ensuring valid results. Three models in particular may prove useful in this process. The first is the results of the meta-analysis by Koufogiannakis and Wiebe (2006) in which they present an updated model of Bloom's taxonomy created by Anderson and Krathwohl (2002). This model can serve as a framework for identifying specific questions. The framework as adopted from Anderson and Krathwohl (2002) is outlined in Table 1.

Table 1 Bloom's revised taxonomy

Bloom's Revised Taxonomy	
Remember	Retrieve relevant knowledge from long-term memory including recognizing and recalling
Understand	Construct meaning from instructional messages, including oral, written, and graphic communication including interpreting, classifying, summarizing, and inferring
Apply	Carry out or use a procedure in a given situation including executing and implementing
Analyze	Break material into constituent parts and determine how parts relate to one another and to an overall structure or purpose including differentiating, organizing, and attributing
Evaluate	Make judgments based on criteria and standards including checking and critiquing.
Create	Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure including generating, planning and producing.

As demonstrated in previous literature reviews, when applied to the concept of metadata literacy, the areas discussed in Anderson and Krathwohl (2002) help describe relevant actions and cognitive states that use of metadata can influence. Within this framework, the self-efficacy test by Kurbanoglu et al. (2006) and their design approach provides an appropriate framework for modeling an ML self-efficacy test. The self-efficacy test which is included in Appendix 1 uses a likert scale to have students assess their own ability and comfort levels regarding literacy.

3. Mixed methods research

3.1. Overview

This section contains a review of relevant approaches to metadata literacy research. The purpose of this review is to identify methods for researching perspectives on the concept of metadata

literacy, particularly within the context of information literacy and information technology use. This review seeks methods for comparing this participant perspective of metadata literacy with their ability to engage in different forms of metadata literacy tasks with the intent of determining how generalized their metadata experience is, how metadata experience and generalization differs between participant groups (e.g. students and teachers) and what aspects of metadata literacy are relevant to participants. Taking this approach requires both quantitative and qualitative data gathering. The following section examines approaches for each of these research tasks.

3.2. Mixed methods research

Creswell (2003) defines mixed methods research as an approach which collects both quantitative and qualitative data and which is geared towards answering "pragmatic knowledge claims"(2003, p. 21). Creswell discusses several approaches to mixed methods research in which the timing and influence of qualitative and quantitative approaches are driven by the needed relationship between the data sets. For example, he discusses the concept of sequential explanatory strategy as employing qualitative data to refine quantitative data (2003, p. 215). Creswell's approach allows the researcher to create/refine qualitative procedures based on the outcome of the quantitative research but runs the risk of creating incompatible data sets. A similar approach which uses qualitative data to inform the perspective of the user creating the quantitative data is called concurrent nested strategy (2003, p. 218). In this approach, the quantitative and qualitative data are collected simultaneously and emphasis is given to a particular approach. By using qualitative data to provide context and meaning to quantitative data participant perspective receives more complete attention. This gives the research a 'broader perspective' than a single data source would give alone (Creswell, 2003). Secondly, by having the two types of data collected in a simultaneous environment, research can better ensure that the data are compatible. This is a marked advantage over other mixed methods approaches which employ a research-refine-research approach to data collection.

This approach could be defined as a mix between inductive and deductive approaches. Blaikie (2000)discusses the retroductive approach as beginning with an observed phenomenon and using research identify a real supporting structure for the phenomenon. Blaikie asserts that a

researcher will form a hypothesis of this phenomenon and use data collection and hypotheses to test the validity of the hypothetical model. Blaikie (2000) observes that retroduction introduces idea of creativity and imagination and the ability to work backwards from data to an explanation into research. Creswell and Plano Clark (2007) present their classification of mixed research methodologies in their 2007 work - triangulation, embedded, explanatory, and exploratory. Their description of these methodologies is summarized and represented in Table 2 (Creswell & Plano Clark, 2007).

Table 2 Mixed methods research approaches

Method	**Features**
Triangulation	Features: Complementary data, overlapping perspectives Collection: Concurrent data collection, Qual + Quan Analysis: Data comparison/contrast, data transformation Purpose: Enhance validity, substantiate claims
Embedded	Features: Data serves a supporting role, Collection: Qual -> Quan or Quan ->Qual, may be single or multi-phase Analysis: Child dataset answers a specific aspect of the larger question Purpose: Provides context to parent data, enhance
Explanatory	Features: Secondary study investigates elements of primary study Collection: Two-phase, secondary study investigates variables from primary study (Qual->(Quan)) Analysis: Data answers separate but related questions, data is not compared Purpose: Explore previously identified phenomenon, characteristics
Exploratory	Features: Derivative study based on primary study Collection: Two-phase, secondary study is derived from primary, sequential Analysis: Data from primary study analyzed to create secondary study Purpose: Instrument design, taxonomy design

Gathering participant observation through qualitative approaches could involve any number of interview, survey, or focus group approaches. Qualitative approaches include holistic methods such as phenomenonology, ethnography, and case study or partial approaches intended to provide contextual information, validity checking, or verification of results from quantifiable studies. This is a key role of qualitative methods in mixed methods research (Creswell & Plano Clark, 2007, p. 34)

As noted in this review, quantitative approaches tend to be more popular in metadata research than in IL research. Some methods that have been used in both metadata and literacy research include surveys, controlled experiments and quasi-experiments. As demonstrated by Anderson (2008), surveys are a popular method of acquiring quantitative data on environment and participant perspective. Kulikowich (2008) points out that experimental and quasi-experimental designs can be difficult to use in literacy studies given the fact that students are typically investigated within their educational environment. As a result, it is difficult to isolate variable treatments and control groups (Kulikowich, 2008, p. 184). Further, the complexity associated with current literacy models means that it is increasingly difficult to find a suitable experiment. As Kulikowich points out, two major determinations to make when setting up experimental settings for literacy research are the technological foundation of the intervention and the location of the intervention (2008, p. 188).

Two significant issues in relation to the creation of an appropriate research setting are the authenticity of the information experience and the connection between demographic/perspective data and participant experience. Creating an authentic information interaction is a significant challenge. Gordon and Pathak (1999) recommend eight considerations when creating such an environment including the need to have searching grounded in a genuine information need, the need to use a realistic search environment, the need to allow the information user to make relevance judgments, and the need for an appropriately large and diverse result set (p. 146) .

This list of qualities of an information interaction in a search engine evaluation also applies to any web-based information interaction. Generalized elements of interaction adapted from Gordon and Pathak (1999) and Hawking et al. (2001) include: (a) the interaction should be motivated by genuine participant need, (b) the primary searcher's information need should be

fully documented, (c) a sufficient sample of interactions should be used, (e) major information systems should be used in the experiment, (f) the best features of these information systems should be used, and (g) judgments of success should be made by the participant. These criteria can serve to effectively inform the design of any web-based information interaction. In order address these issues, real-world information problems can be used which are relevant and accessible to the target population.

In the proposed research appropriate models should be employed to provide the participant with appropriate choices. For example, in asking the participant to define their concept of literacy, it is appropriate to present the framework of literacies from the literature review for the participant to choose from. Second, when asking the participant to evaluate the relevance of metadata literacy, it is appropriate to use a framework of benefits and qualities of technology pulled from the technology acceptance model and grounded in self-efficacy based metrics.

3.3. Research approach observations

Previous work by the researcher has focused on qualitative and quantitative research in this area e.g. Mitchell and Smith (2008), Mitchell (2007), and Smith, Mitchell and Numbers (2007). These studies investigated a variety of methodologies including quantitative and qualitative surveys, embedded classroom observation, and analysis of student work. While none of the studies were experimental or quasi-experimental in nature, the variety of methodologies and data analysis tools employed helped explore the roles of literacy and metadata in a variety of student-centered information environments including structured digital libraries, open research settings, and social settings. As this research discovered, given the rapidly changing nature of the information spaces being used for research and the wide range of student experiences coming into those spaces, qualitative and non-experimental quantitative studies are still useful tools for shaping research in this area. As Kulikowich (2008) observes, creating experimental settings for literacy research can be difficult given the fact that most experimentation occurs over time in a classroom environment. Further, significant ethical issues are involved in creating control groups when the primary goal of these environments is to teach and learn. It should not be a surprise then that many of the studies on literacy focus on qualitative approaches including interviews, observation and survey based or limited interaction quantitative studies. Some

approaches documented in Anderson's (2008) chapter discuss large scale survey research. Anderson's observation that these sorts of studies can be difficult to complete contrasts with Kendall's investigation of mixed methods approaches in smaller environments.

The net impact is that in studies which seek to explore an emerging literacy or concept may do as well to conduct smaller scale qualitative or quantitative studies as to attempt highly structured experimental research. Literacy involves the elements of teaching/learning, cognition, information and technology skills, foundational beliefs and has a complex relationship with domain knowledge. As such, it can be difficult if not impossible to control all of the variables that are likely to be encountered in a study.

4. Instrument design

There are a number of instruments that are appropriate for conducting quantitative, qualitative, and mixed-methods research. Survey instruments are one of the primary methods by which self-efficacy data is collected. Because of this, the focus of this section is on issues surrounding the use of survey instruments to conduct research. Surveys are useful for exploring relationships, examining beliefs and attitudes, and are a good mechanism to reach a wide audience (Colton & Covert, 2007, p. 10). In contrast, surveys (particularly participant completed) are subject to mis-interpretation and limit data acquisition (Colton & Covert, 2007, p. 11). It is the goal of this research to identify core principles by aggregating the perspectives of multiple participants.

One issue with relying on survey instruments, particularly in the case where participants are being asked to consider a complex topic, is the inconsistency between how a participant actually feels and how they answer the survey. As Colton and Covert (2007) observe, this may include answering as if they are more knowledgeable than they are, choosing beliefs or behaviors to represent instead of their own, and variation in beliefs and responses (p. 131). Further, Colton and Covert outline elements that influence participant behavior during survey responses. Wording and question perspective, question ordering, construction, usability, and the extent to which a survey makes a participant uncomfortable can have an impact on how the survey is completed (2007, p. 132). Surveys provide a means for conducting a focused mixed-methods

study and allows mixing of both quantitative and qualitative interactions in a single space. Further, surveys allow online interaction therefore boosting the number of participants.

Validity is a means of assessing that the instrument in question gathers the data it attempts to gather. There are multiple types of validity that are related to survey construction. Colton and Covert discuss a wide range of validity concepts including face validity, construct validity, content validity, and criterion validity (Colton & Covert, 2007, p. 65). These types of validity and their meaning are represented in Table 3.

Table 3 Types of instrument validity

Method	**Features**
Face validity	Instrument appears to gather accurate data
Construct validity	The constructs being used to assess a given phenomenon are commonly understood by the participants. Construct validity includes convergent validity (measurable relationship between related constructs) and discriminant validity (measurable lack of relationship between divergent constructs).
Content Validity	The extent to which the instrument investigates the phenomenon being investigated
Criterion validity	The extent to which the measures in the instrument match external standards.
Predictive validity	The extent to which the instrument is successful in predicting secondary variables from primary variables. (GPA scores based on SAT scores)
Multicultural validity	The extent to which an instrument is tuned for a specific audience.

Colton and covert discuss both qualitative and quantitative methods of assessing instrument validity. Qualitative approaches include literature review, expert testing, and table of specifications. A table of specifications is either deductive in which specific questions are asked by exploring a core concept or inductive in which a broad concept is generalized through the

analysis of specific questions (Colton & Covert, 2007, p. 71). Quantitative approaches include testing the instrument alongside another that investigates the same construct and using inter-instrument item analysis (2007, p. 72). Reliability is a related concept to validity in that it assesses the extent to which the measurement of the construct is valid and repeatable. Some of the techniques for establishing reliability of an instrument include eyeballing and proportion of agreement (Colton & Covert, 2007). In eyeballing reliability, informal comparison of instrument results from multiple administrations to the same group of people in a short period of time. In proportion of agreement reliability measures the researcher calculates the percentage of similar results over multiple administrations of an instrument.

Colton and Covert also discuss several methods for determining reliability via instrument administration including administering parallel forms of an instrument, and splitting the items in an instrument to be administered separately. Quantitative analysis of these results include Cronbach's alpha and Pearson's product moment coefficient (Colton & Covert, 2007, p. 78). Interrater and intrarater reliability refer to the ability of multiple raters to assess a phenomenon equally (interrater) and the ability for a rater to assess multiple instances of a phenomenon equally (intrarater). Colton and Covert point to Cohen's kappa as a means of quantifying interrater reliability.

In order to address these issues, a survey can be evaluated by experts in the field (content validity) and piloted with a small group of participants (construct validity). As observed by Colton and Covert, pre-testing is a valuable part of the design and validation process. It helps focus and refine the instrument as well as provide data on validity and reliability. Colton and Covert discuss a number of techniques for pretesting including the use of interviews, focus groups, content area experts, instrument creation experts, and potential users (2007, p. 136). During testing of the instrument, Colton and Covert suggest asking a series of questions to the respondent including the clarity of directions, spelling or grammatical problems, participant interpretation of questions, accessibility issues, overall reactions, and further suggestions (2007, p. 140). This can provide evidence for face/content validity, construct validity, and convergent/discriminant validity. While research on metadata literacy could involve any population class, the nature of the intervention should be closely tied to the population surveyed.

Also, given the interest in self-efficacy regarding IL concepts, it would be beneficial to involve participants for whom the skills discussed in IL forums are familiar (e.g. research).

As seen from this review, survey based research allows the researcher to create a valid and reliable instrument, extend the study to a large population, and enables the gathering of qualitative and quantitative data. Issues related to survey used include limited participant interaction, lack of opportunity to follow-up with participants, and lack of assuredness of participant response rate. Despite these issues, survey based research allows instruments such as a self-efficacy instrument to be reliably and consistently administered to a population.

5. Conclusion

This literature review has investigated research in IL and metadata fields and has considered how research in this area could be completed given the overarching self-efficacy research perspective of this review. It found that both the metadata and information literacy fields use a mix of research approaches including small-scale qualitative studies and larger quantitative studies. Further, this review found that there are a number of issues involved in finding an appropriate metric to evaluate levels of literacy or proficiency with a concept. This review did establish that self-efficacy metrics are a reliable and valid method for identifying participant proficiency and comfort level and that self-efficacy studies are a good bridge between qualitative and quantitative approaches. By using a self-efficacy evaluation scale to establish a base-level and using it again at the end of the interaction to measure changes in levels, research in this area can assess level of learning or familiarity as a function in change of self-efficacy. This review of methods also found that the constructivist paradigm is an appropriate way to approach literacy research. As metadata literacy is an emerging concept, conducting research in a way that allows participants to establish meaning and boundaries allows the proposed study to stay grounded in real-world situations.

The self-efficacy approach does have some significant limitations however. First, the literacy or metadata element being investigated must be fairly limited or focused in nature. Asking participants to rate perceived ability across a wide range of skills or concepts would most likely dilute the response. Second, self-efficacy ratings do not attempt to use a definitive assessment of

skills or abilities in the participants. While there is ample evidence that self-efficacy is a reliable indication of ability, the confidence paradox that can exist in participants may lead to results which are not an accurate reflection of real-world competencies. It is hoped that more information is gained in this early research by seeing how participants succeed in relation to their own self-efficacy claims than in determining their IL level based on some prescriptive test. Finally, given the intent to perform a single intervention, it may prove difficult to really assess levels of metadata literacy, much less to assess ML from the three perspectives of concepts, skills, and context.

While these are limitations of the reviewed methodology, conducting research using these methods would contribute to both the fields of metadata and information literacy research by gathering quantitative participant-focused data which informs how participants think about metadata and how competent they feel with regards to it. This series of literature reviews has cast a wide net across the fields of information literacy and metadata research while asking the central question "what value does metadata bring to learning and knowledge?" The reviews found that metadata is considered to be an important part of learning and knowledge creation, that metadata creation and use is influenced by social and technological theories that help us understand participant motivations and expected outcomes when interacting with metadata in digital texts. It further found that metadata is of increasing importance in digital texts and environments and that it serves primary organization and cognitive roles in these environments. The proposed research resulting from this review of literature will investigate the current state of knowledge of metadata and perceptions about its utility in two participant groups who tend to use metadata-rich information systems. By using a self-efficacy approach, the proposed research will remain grounded in participant observations but will also be able to look comparatively across these two groups.

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Appendix 1

	I feel confident and competent to							
A1	Define the information I need	1	2	3	4	5	6	7
B2	Identify a variety of potential sources of information	1	2	3	4	5	6	7
B3	Limit search strategies by subject, language and date	1	2	3	4	5	6	7
B4	Initiate search strategies by using keywords and Boolean logic	1	2	3	4	5	6	7
C5	Decide where and how to find the information I need	1	2	3	4	5	6	7
C6	Use different kinds of print sources (i.e. books, periodicals, encyclopedias, chronologies, etc.)	1	2	3	4	5	6	7
C7	Use electronic information sources	1	2	3	4	5	6	7
C8	Locate information sources in the library	1	2	3	4	5	6	7
C9	Use library catalogue	1	2	3	4	5	6	7
C10	Locate resources in the library using the library catalogue	1	2	3	4	5	6	7
C11	Use internet search tools (such as search engines, directories, etc.)	1	2	3	4	5	6	7
C12	Use different kinds (types) of libraries	1	2	3	4	5	6	7
D13	Use many resources at the same time to make a research	1	2	3	4	5	6	7
D14	Determine the authoritativeness, currentness and reliability of the information sources	1	2	3	4	5	6	7
D15	Select information most appropriate to the information need	1	2	3	4	5	6	7
D16	Identify points of agreement and disagreement among sources	1	2	3	4	5	6	7
D17	Evaluate www sources	1	2	3	4	5	6	7
E18	Synthesize newly gathered information with previous information	1	2	3	4	5	6	7
E19	Interpret the visual information (i.e. graphs, tables, diagrams)	1	2	3	4	5	6	7
F20	Write a research paper	1	2	3	4	5	6	7
F21	Determine the content and form the parts (introduction, conclusion) of a presentation (written, oral)	1	2	3	4	5	6	7
F22	Prepare a bibliography	1	2	3	4	5	6	7
F23	Create bibliographic records and organize the bibliography	1	2	3	4	5	6	7
F24	Create bibliographic records for different kinds of materials (i.e. books, articles, web pages)	1	2	3	4	5	6	7
F25	Make citations and use quotations within the text	1	2	3	4	5	6	7
F26	Choose a format (i.e. written, oral, visual) appropriate to communicate with the audience	1	2	3	4	5	6	7
G27	Learn from my information problem solving experience and improve my information literacy skill	1	2	3	4	5	6	7
G28	Criticize the quality of my information seeking process and its products	1	2	3	4	5	6	7

Notes: This scale has been prepared to determine your level of efficacy on issues related with the information (to find, use and communicate information) Here the notations shall be referred to as 7 = almost always true, 6 = usually true, 5 = often true, 4 = occasionally true, 3 = sometimes but infrequently true, 2 = usually not true, 1 = almost never true. Please mark the most suitable choice for you. Thanks for your cooperation. A = Defining the need for information B = Initiating the search strategy C = Locating and accessing the resources D = Assessing and comprehending information E = Interpreting, synthesizing, and using information F = Communicating Information G = Evaluating the product and process