Negotiating the Digital Maze of Information Literacy: A Review of Literature

Robin H. Kay and Kamran Ahmadpour

University of Ontario Institute of Technology

Abstract

Rapid change in technology, conflicting definitions and perspectives, and competing models make it difficult to develop a consistent and coherent understanding of information literacy. A comprehensive search of 50 peer-reviewed articles between 2004 and 2014 was conducted to identify major research themes in understanding information literacy. Five key areas associated with information literacy were reviewed, including evolutionary history, proposed definitions, foundational learning theories, digital literacy, and previous information literacy models. Based on a detailed content analysis of previous research, a 4Ps framework (planning, picking, processing, and producing) was developed and analyzed to synthesize the results.

Negotiating the Digital Maze Of Information Literacy:

A Review of Literature

Introduction

Information literacy has garnered increasing interest over the past 20 years for at least three reasons. First, the Net Generation, those individuals born between 1977 and 1997 (Tapscott, 2009), has grown up with digital technology but paradoxically appears to lack information skills (Rockman, 2002). Second, the diversity and number of information sources has led to cognitive overload and increased anxiety (Bawden & Robinson, 2009). As the number of information sources increases, students' need to develop skills to seek, access, evaluate, manage, and use information effectively and efficiently also increases. Third, information literacy has been recognized as one of the essential life, learning, and workplace skills (Eisenberg, 2008), and, according to UNESCO, is a "basic human right in a digital world" (Alexandria Proclamation, 2005, p. 3). Consequently, the study of information literacy has become a very active research domain in the last two decades.

Despite the growth of literature, at least three key issues have inhibited the development of a comprehensive, cohesive understanding of information literacy. First, existing definitions of information literacy are either ambiguous or too narrow in focus (Bawden, 2001; O'Farrill, 2010; Saranto & Hovenga, 2004; Sundin, 2008). Second, traditional defining characteristics of information literacy do not adequately incorporate socially networked environments (Dunaway, 2011; Eshet, 2012; Mackey & Jacobson, 2011). Third, there are conflicting perspectives on what is important in literacy (Elmborg, 2006), including solving real-world problems (Doherty & Ketchner, 2005), constructivism

(Lloyd, 2005, 2007, 2012; Lloyd, Kennan, Thompson, & Oayyum, 2013), multiple literacies (Lankshear & Knobel, 2003), and interpretation of media (Ng, 2012; Rebmann, 2013).

Previous Literature Review

Three previous literature reviews have been conducted in the area of information literacy (Julien & Mckechnie, 2005; Pinto, Cordon & Diaz, 2010; Saranto & Hovenga, 2004). Julien et al. (2005) reviewed 242 articles between 1999 and 2003 focussing on affective variables (e.g., emotion or confidence) and information literacy. They concluded that most researchers target information "systems" and pay little attention to affective influences. Pinto et al. (2005) examined conceptual perceptions of information literacy, from 1977 to 2007, by examining key terms used in a wide range of databases. They reported the following alternative terms for information literacy: information skills, library skills, technological literacy, Internet literacy, computer literacy, and digital literacy. Finally, Saranto & Hovenga (2004) reviewed 65 papers and 32 abstracts from 1995 to 2001 to determine how information literacy is defined in the field of health, nursing and medical informatics. They concluded that the term "information literacy" was not explicitly used and is tangentially referred to as computer literacy, informatics awareness, or computer experience.

The three literature reviews (Julien & Mckechnie, 2005; Pinto, Cordon, & Diaz, 2010; Saranto & Hovenga, 2004), while informative, are limited in at least two ways. First, the reviews are dated, focussing on research and perspectives from 1995 to 2007. The potential influence of technology, which has advanced rapidly in the past 10 years, needs to be considered when examining information literacy in today's predominantly digital environment. Second, the scope of these reviews is somewhat narrow, focussing on

specific parameters (e.g., affect), domains (e.g., health), or terms and definitions used to refer to the concept of information literacy. To understand and evaluate the concept of information literacy in a digital era, a current and more comprehensive review of the literature is required to address a broader range of issues and domains.

Purpose

The purpose of the current study was to conduct an extensive review of the literature with the intent of developing a comprehensive framework for understanding information literacy.

Method

Procedure

To ensure high quality and current information, we took the following steps. First, we selected peer-reviewed journal articles from 2004 to 2014 focussing on defining characteristics and dimensions of information literacy.   Second, after reviewing a number of initial papers, a set of keywords emerged that was used to search titles and abstracts of additional papers. These keywords included information literacy, digital literacy, new literacies, information technology literacy, 21st century skills and information literacy, information literacy, metacognitive skills, and information literacy and social skills. These keywords were used to search both titles and abstracts. Third, we searched a variety of well-established research databases, including Scholars Portal, EBSCO Host, EDITLib, and Google Scholar. Fourth, we examined the reference section of all articles to locate additional relevant references. The search process produced 50 peer-reviewed articles focussing on two distinct domains: academic (n=36), and workplace or general life experiences (n=14). The type of articles collected included theoretical (n=32), qualitative

(n=7), survey-based (n=5), mixed-method (n=3), and literature reviews (n=3). See

Appendix A for a complete list of the articles reviewed.

Each publication was read in detail and key points related to information literacy

were highlighted. The important points were reviewed and entered into spreadsheet with

four columns: author and year, category, sub-category, detailed comment. A category and

sub-category were assigned for each distinct point recorded for an article. These

categories emerged from articles and were continually reviewed and refined to ensure

consistency.

Literature Review

Overview

Five key themes that emerged from the literature review will be addressed. First,

the evolution of information literacy will be discussed. Second, a review of information

literacy definitions will be offered. Third, key learning theories related to information

literacy will be presented. Fourth, the concept of digital literacy will be introduced and

compared to information literacy. Fifth, a detailed review of previous information literacy

models will be examined. Finally, a "4Ps" framework will be introduced and aligned with

previous information literacy models.

Evolution of Information Literacy

In 1974, Paul Zurkowski, a lawyer by profession, first coined the term "information

literacy" in a proposal submitted to the National Commission on Libraries and Information

Science (Badke, 2010; Wen & Shih, 2008):

> People trained in the application of information resources to their
> work can be called information literates. They have learned techniques
> and skills for utilizing the wide range of information tools as well as

primary resources in molding information-solutions to their problems. (Zurkowski, 1974, p. 6)

Zurkowski's emphasis was on the private sector (Bowden, 2001), and his concern was using information skills as a problem-solving approach for workplace contexts (Pinto et al., 2010). The next phase in the evolution of information literacy occurred within the field of library sciences. Librarians and academics associated information literacy with bibliographic instruction programs in the form of short orientations on how to use library and information resources (Pinto et al., 2010).

With the advent of digital technology in the 1980s, information literacy expanded beyond library resources to include technological literacy, information and communication technology (ICT) literacy, digital literacy, and computer literacy (Pinto et al., 2010). Information literacy at this stage was viewed as tool-based, with a focus on technology.

Rapid and constant advancements in information technology led to exponential increases in information resources. Knowing how to use computers and access information was no longer sufficient for locating and extracting relevant information from an increasingly complex digital environment. Therefore, the need to include competencies such as critical thinking, evaluation skills (Spiranec & Zorica, 2010) and cultural support (Pinto et al., 2010) were more prominent when referring to information literacy.

The affective nature of information literacy was also considered as an essential requirement (Nahl, 2001). Studies on affective aspects of information began with Kuhlthau (1991) and continued with several others, including Julien and Mckechnie (2005), Bilal and Bachir (2007), and Lopatovska and Mokros (2008). This trend led to a new perspective of information literacy research and practice where the information seeker was viewed as a whole person. For example, Matteson (2014) explored the relationship among several

constructs when determining individual information literacy scores, including cognitive abilities, emotional intelligence, and individual perceptions.

Recently, Web 2.0 technology has begun to play an important role in information literacy, leading to a drastic change in collaboration, communication, and sharing associated with collecting, evaluating, and processing information. Mokhtar et al. (2009), and Spiranec and Zorica (2010) maintain that these Web 2.0 developments have substantially altered the social dynamic of information literacy.

Finally, education practice has influenced information literacy. Spiranec and Zorica (2010) noted constructivism in the classroom repositioned students as creative and reflective users of information. Farkas (2012) added that social constructivism and connectivism in a web-based classroom promotes democratic, collaborative knowledge construction. Nevertheless, while information literacy and educational practice are strongly linked, Bruce (2004) views information literacy as a critical lifelong learning process that empowers us both personally and economically.

In summary, the concept of information literacy has evolved and grown over time. Initially, it was viewed as a problem-solving approach within the context of the private sector. Then, it was conceptualized by the library sector as learning about information sources that libraries offer. Next, it was associated with information technology, technical skills, and databases. Information literacy further developed through the lenses of critical thinking skills, collaboration, communication, and social practice via the web, affective competencies, and lifelong learning.

Definitions of Information Literacy

The American Library Association [ALA] (1989) first defined information literacy as "a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (p.1). Eisenberg (2008), from a more academic than library-based perspective, defined information literacy as "the set of skills and knowledge that allows us to find, evaluate, and use the information we need, as well as to filter out the information we don't need" (p. 39). Eisenberg's (2008) definition is similar to that of ALA (1989), but his emphasis is more on filtering out irrelevant information due to advancement in information technology and the complexity of the information environment. Both of the above definitions are somewhat limited, though, because they view information literacy as a set of skills to be achieved individually.

Bruce's (1997) relational model offered an alternative approach to defining information literacy by highlighting the way the user perceives information literacy. She claimed that information literacy entailed being aware of various ways of experiencing information through pertinent practices and reflections (Bruce, 2004). Rather than offering a set of skills or processes, Bruce (1997) presented seven ways in which one experiences information literacy: information technology, information sources, information process, information control, knowledge construction, knowledge extension, and wisdom experience. Learning happens when we identify and act upon various ways of experiencing something (Bruce, Edwards, & Lupton, 2006). Bruce's (1997) definition relies on a learner's behaviour and perception, and, thus, is more conceptual than practical.

Tuominen, Savolainen, and Talja (2005) defined information literacy as a socio-technical practice. They argued that information literacy was embedded in the actions of

specific communities that use socially-driven technologies. Tuominen et al.'s (2005) idea of socio-technical practice emphasizes concepts such as collaboration, sharing, technological artifacts, and context.

Finally, the Alexandria Proclamation, sponsored by UNESCO, viewed information literacy as a way to "empower people in all walks of life to seek, evaluate, use and create information effectively to achieve their personal, social, occupational and educational goals" (Garner, 2006, p. 3). This definition was purposely designed to be all-inclusive and general, but provides limited detail on the specific skills and acumen required to be information literate.

Despite some similarities among various definitions, consensus on how to define information literacy does not exist (Sundin, 2008). Mackey and Jacobson (2011) argue that the current definitions are not comprehensive enough. Lloyd (2005) maintains that information literacy contains various perspectives and practices, yet we are not able to fully capture its depth and breadth. Specifically, information literacy has been defined mostly through a textual (where the interaction is between an individual and a text he or she reads) rather than a social practice (Lloyd, 2012). The continual shift in emphasis on what is important in information literacy changes with rapid advancement in information technology and infrastructure. Defining information literacy, then, is somewhat analogous to aiming at a constantly-moving target.

Learning Theories and Information Literacy

The impact of three prominent learning theories (constructivism, social constructivism, and Bloom's taxonomy) on the shifting perspectives of information literacy will be presented. These theories have had profound impacts on the way information

literacy is interpreted today. It is within the context of these new learning theories that information literacy is evolving and moving beyond a set of static, generic skills and knowledge.

Constructivism. Many elements of constructivism are derived from the work of Jean Piaget (Davis & Sumara, 2002). Key aspects of Piaget's concept of constructivism include individual construction of mental models and knowledge structure (Savolainen, 2009). Learning is viewed primarily as an internal process. The individual constructivist framework has significantly influenced the concept of information literacy in at least four ways. First, many information literacy theorists believe individuals are active builders of meaning and should be independent and self-sufficient (Tuominen et al., 2005). Second, constructivism has moved information literacy beyond accounting for the external behaviours of information seekers to actually understanding the individual's own points of view about their information-seeking behaviours (Sundin, 2008). Kuhlthau's (1991) Information Search Process (ISP) model is referred to as an example of this perspective of information literacy (Tuominen et al., 2005; Sundin, 2008). Third, the constructivist perspective shifted the concept of information literacy away from passive knowledge transfer toward knowledge construction and reflection (Spiranec & Zorica, 2010). This revised perspective speaks to Savolainen's (2009) description of information users as active sense makers of their environment – not parts of a passive processing system (Savolainen, 2009). Finally, constructivists maintain that individuals are "engaged" if they are searching for relevant personal goals (Jeffery et al., 2011).

Social Constructivism. Vygotsky-inspired constructivists view learning primarily as a social process (Davis & Sumara, 2002). According to social constructivism, while the

individual mind is important in constructing meaning, social contexts, interactions, and

alternative perspectives are critical as well (Savolainen, 2009). From a social constructivist

perspective, the social-sense making process takes precedence over individual sense-

making, and emphasis is placed on communities, conversations, situations, and practices

(O`Farrill, 2010).

Traditionally, social constructivism did not play a prominent role in information

literacy – few approaches or models considered how individuals interacted with one

another when searching for and processing information (Tuominen et al., 2005). This

trend, however, started to change with the emergence of Web 2.0 technology, which

transformed the landscape in which individuals selected and produced information

(Farkas, 2012). Since collaboration and sharing information has become much easier,

online communities of practice have formed and some researchers have begun to

investigate collaborative practice in information literacy (Abdi, Partidge, & Bruce, 2013).

Information literacy also began to be associated with the notion of co-construction (Lloyd,

2010). These new ideas have influenced the way information literacy is understood in

workplace environments (Lloyd, 2005, 2007, 2012). With this new understanding,

information is viewed from the perspective of collaboration, social interaction, and

dialogue.

Bloom's Taxonomy. Bloom's taxonomy, developed in the 1950s, is a set of

educational objectives presented in a learning-process hierarchy. It organizes the

educational goals into three categories: cognitive, affective, and psychomotor. The

cognitive dimension receives the most attention in information literacy. The learning

hierarchy of the cognitive dimension of Bloom's taxonomy places knowledge at the lowest

level, and increasingly gets more complex as it moves through the levels of comprehension, application, analysis, synthesis, and evaluation (Bloom, 1956). Bloom's taxonomy was later revised by Anderson, Krathwohl, and Bloom (2001) who changed the noun-based cognitive categories of Bloom (1956) into verbal categories such as remembering, understanding, applying, analyzing, evaluating, and creating.

Regarding information literacy, Bloom's taxonomy or its updated version, has been used regularly as a basis to compare information literacy skills (Andreae & Anderson 2012; Cahoy, 2010; Keene et al., 2010; Kessinger, 2013; Schroeder & Neuman, 2011; Spring, 2010). Kessinger (2013), for example, uses the six steps of Bloom's taxonomy to devise a research support framework to enhance information literacy skills of undergraduate students. Spring (2010) compares Bloom's taxonomy and the seven pillars model of Society of College, National and University Libraries (SCONUL) in the UK to provide an evidence-based approach in teaching and understanding information literacy.

Digital Literacy

A review of research on digital literacy suggests that it is closely connected to the concept of information literacy. Some authors have suggested that digital literacy generally refers to a set of technical skills (Bawden, 2001). Others have argued that digital literacy extends beyond the technical domain. Gilster (1997), for example, defined digital literacy as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p.1). Gilster's (1997) definition had much in common with key features of information literacy. He emphasized that digital literacy was not about digital or technical components but about the ideas that we master. Mackey and

Jacobson (2011) added that digital literacy refers to critical thinking and not just learning technical skills.

Eshet-Alkalai (2004) provides a comprehensive approach to digital literacy by articulating five sub-categories including photo-visual literacy, reproduction literacy, information literacy, branching literacy, and socio-emotional literacy. Photo-visual literacy refers to the ability to read visual representations of the digital environment, incorporating text, sound, images, and symbols. Reproduction literacy signifies the ability to create and reproduce knowledge from the existing rich information environment. Information literacy focuses on the ability to access, find, and evaluate information coming from a large number of sources. Branching literacy looks at hypermedia and the ability we need to navigate in the interactive and non-linear world of hypermedia. Finally, social and emotional literacy refers to one's ability to behave appropriately in cyberspace.

Bawden (2001) put forth a thorough understanding of digital literacy by compiling an extensive list of required skills based on Gilster's (1997) anecdotal description of digital literacy, including critical thinking, reading comprehension, knowledge assembly, online searching, problem solving , communication and online publishing, and awareness of online social resources. Both Eshet-Alkalai (2004) and Bawden (2001) provide detailed metrics that blur the distinction between digital and information literacy.

Several theorists have attempted to address the considerable overlap between the concepts of information literacy and digital literacy. Mackey and Jacobson (2011) suggest that digital literacy only applies to activities that occur within a digital environment, whereas information literacy can apply to activities that may not include technologies. However, in the 21st century, most, if not all information is available or stored in a digital

format, so Mackey and Jacobson's (2011) distinction may not be applicable (Spiranec & Zorica, 2010).

One possible way to distinguish information and digital literacy is to determine the focal point of reference. When the focal point is finding and using information, digital literacy is a subcomponent that helps support this process in a predominantly digital environment. However, other necessary skills such critical thinking, problem solving, communication, social awareness, and collaboration are required (Bruce , 2004; Farkas, 2012; Lopatovska & Mokros, 2008; Spiranec & Zorica, 2010). When the focal point is learning to use digital technology, information literacy, as Eshet-Alkalai (2004) suggests, is a subcomponent that can support the process of understanding and acquiring new skills. However, there is a wide range of digital skills that go beyond information literacy, including visual, reproduction, branching, and socio-emotional skills (Eshet-Alkalai, 2004).

Previous Information Literacy Models

Several key researchers have developed information literacy models (Eisenberg & Berkowitz, 1990; Kuhlthau, 1991; Neuman, 2011). This review will examine the models that have been used and referred to the most in educational contexts: Eisenberg & Berkowitz' (1990) "Big Six Model," Kuhlthau's (1991) "Information Search Process (ISP)" model, and Neuman's (2011) "I-LEARN model."

The Big Six Model. A widely recognized model of information literacy, particularly in K-12 education, is the Big Six Skills model developed almost 25 years ago by Eisenberg and Berkowitz (1990). The Big Six model offers a systematic framework for using information to solve problems and consists of six stages:

- defining the problem and information requirements (task definition);

- establishing and prioritizing information seeking strategies (information seeking strategies);

- finding sources and information (location and access);

- engaging and extracting information (information use);

- organising and presenting information (synthesis, and evaluation); and

- judging the process and product of information seeking (evaluation).

Eisenberg (2008) emphasized three essential components for successful learning and teaching of information literacy: the information process, technology, and real needs. According to Eisenberg (2008), the information process gives students a structure so that they know where they are in their problem-solving journey. The technology presents students with the focus and flexibility to develop their specific information skills. Finally, real needs make information literacy relevant and transferable to students. It is only through integrating technology skills with the information problem solving process and real-life needs that effective information skills can be developed. The Big Six model is not context sensitive and therefore it is applicable to a variety of settings.

Some scholars find the Big Six model too restrictive with respect to recent changes and issues in technology and information. Mokhtar et al. (2009) proposed three additional elements to Eisenberg and Berkowitz' (1990) Big Six model: collaborative information seeking behaviour, attitudes and perceptions, and ethics and social responsibility. They argued that with the emergence of Web 2.0 and social networking services, the characteristics of the information seeking process are far more interactive and collaborative. Mokhtar et al. (2009) emphasized motivation, self-efficacy, and respect for various opinions as essential elements for becoming information literate. They also

consider ethics and social responsibility as helpful components so that individuals become more than just information literate, but responsible users of information.

The Information Search Process (ISP) Model. The Information Search Process (ISP) model (Kuhlthau, 1991), proposed almost 25 years ago, divides information searching into six steps:

- initiation, or recognizing an information need (initiation),

- identifying a general topic and how to proceed (selection),

- exploration of the general topic and possible confusion (exploration),

- formulation of a specific focus (formulation);

- collection, or gathering of relevant information (collection); and

- summarize and report information (search closure).

Kuhlthau's (1991) model incorporates three areas: the physical (actual actions taken), the affective (feelings experienced during the search process), and the cognitive (thoughts concerning both process and content). Kuhlthau's (1991) focus on the affective component of information literacy is unique. She maintains that underdeveloped affective skills are barriers to the information seeking process (Cahoy, 2013). In examining the affective aspects of the model, Kuhlthau, Heinstrom and Todd (2008) tracked nine feelings through their data collection: confidence, disappointment, relief, frustration, confusion, optimism, uncertainty, satisfaction, and anxiety.

The I-LEARN Model. The I-LEARN model, recently proposed by Neuman (2011), is similar to the Big Six (Eisenberg & Berkowitz , 1990) and ISP (Kuhlthau, 1991) models in that it provides a set of skills or processes to describe information literacy. The letters of the term I-LEARN signify six stages including

- activating a sense of curiosity, scanning the environment, and formulating a
  question or problem (Identify);

- locating the needed information through focusing on what is to be learned, finding
  the candidate information needed, and extracting the most relevant information
  (Locate);

- evaluating information through questioning its authority, relevance, and timeliness
  (Evaluate);

- applying that information through generating new understanding, organizing that
  information-based understanding and communicating that new understanding in a
  usable way (Apply);

- reflecting on the process and product of learning through analyzing, revising and
  refining (Reflect);

- knowing what is learned through internalizing it, personalizing it, and activating it
  in the future (Know)

According to Neuman (2011), in a library setting, what matters more is how to

access various resources and how to evaluate them based on our identified need. He

particularly emphasized the concept of learning; the main reason why information is

sought in the first place is learning. He noted that other models influenced by library

science concentrated more on the information seeking process than on learning.

The 4Ps Framework

For the purpose of this review, four new terms are proposed to summarize the core

processes of information literacy: planning, picking, processing and producing. The

primary intent of the 4Ps framework is to (a) compare previous models and relevant

discourses of information literacy and (b) to establish an updated perspective that incorporates key parameters from the digital world (see Table 1). The processes in the 4Ps framework are considered non-linear because a shift may happen from one process to another and back at any time depending on the information attained and processed. The non-linear nature of the 4Ps framework will be discussed in more detail after each process is examined.

Table 1. Comparison between models of Information Literacy

4Ps	Big 6 Model	Information Search Process Model	ILEARN Model
Planning	*Task Definition* • Define problem • Identify Information Needed	*Initiation* • Recognizing information need *Selection* • Identify topic and how to proceed	*Identify* • Activate, Scan, Formulate
Picking	*Information Seeking* • Determine range of sources • Prioritize Sources *Location & Access* • Locate Sources • Find information *Use of Information* • Engage (read, view) • Extract relevant information	*Exploration* • investigate information on the general topic *Collection* • collection, or gathering of relevant information	*Locate* • Focus, Find, Extract
Processing	*Evaluation* • Judge the product • Judge the process	*Exploration* • confusion during exploration process *Formulation* • formulation of a specific focus	*Evaluate* • Authority, Relevance, Timelines *Reflect* • Analyze, Revise, Refine Know • Internalize, Personalize, Activate
Producing	Synthesis • Organize from multiple sources • Present information	*Search Closure* • summarize and report information	*Apply* • Generate, Organize, Communicate *Reflect* • Revise, Refine

Planning. The first P in the 4Ps framework represents information *planning*. One

of the earliest steps in information literacy is establishing what information is needed

based on a problem and planning ahead. Information seekers plan what information they

need to find and assess their progress accordingly (Gorrell, Eaglestone, Ford, Holdridge, &

Madden, 2009). To plan ahead, learners need to understand the topic or problem at hand

and predict the possible solutions. However, goals and plans keep changing as the

information seeker strives for answers or solutions and does not find them. In addition,

key issues and even the original problem may change as more information is gathered and

digested. All three previous models fully articulated this process under the labels of task

definition (Eisenberg & Berkowitz, 1990; Eisenberg, 2008), initiation (Kuhlthau, 1991) and

identifying (Neuman, 2011) (see Table 1). However, the need for developing a detailed and

well-formed plan may not be as critical as it was 25 years ago when the Big Six and ISP

models were first articulated. Access to digitally stored information is rapid and might lead

to a more trial and error approach to information seeking. In addition, changes in problem,

key issues, and focus may occur more quickly than it did in the past, due to the volume of

and perspectives on information that can be gleaned in a digital environment.

Picking. The second P in the 4Ps framework stands for *picking*. We can pick or

select information individually via text (print/digital), physical senses (observing/ hearing)

or while collaborating with other individuals in a particular context. Wilder (2005) noted

that one of the flaws in the current concept of information literacy is that it leads

individuals to seek or search relevant information, whereas the real challenge today is in

finding high quality and relevant information among the wealth of digital resources available. Similarly, an important part of information literacy, according to Beeson (2006), is to be able to judge found information based on the searcher's plans and goals with acceptable speed and accuracy.

The Big Six model devotes three stages to the picking process including information seeking, location and access and use of information (Eisenberg & Berkowitz, 1990; Eisenberg, 2008). The ISP model describes this process as exploring and collecting information (Kuhlthau, 1991) while emphasizing the affect components such as uncertainty, optimism, confusion, and confidence. The I-Learn model narrows this process down to focussing, finding and extracting (Neuman, 2011). All three perspectives add considerable depth to the picking or selecting process (see Table 1), however, they do not allow for the complexities and nuances of a digital environment. For example, having effective searching and seeking information skills is a major part of being information literate, but information literacy in a digital landscape does not always require us to search. New technology tools such as RSS web feeds delivers relevant information directly to our computers. Furthermore, since the advances in information retrieval have made searching and accessing information easier than ever, the term "pick" requires higher-order skills such as evaluating the validity and relevance of information we select. Finally, it is important to note that while picking information in the past was often an individual process, the plethora of digital communication tools increases the likelihood that the selection process is indirectly or directly collaborative. In other words, the picking of resources is more than likely to be influenced by the readily available opinions, suggestions, and guidance of other individuals.

Processing. The third P in the 4Ps framework is *processing*. Both cognitive

constructivism and information processing approaches view information as being

processed and interpreted in our minds (Savolainen, 2009). Processing of information

through critical thinking and evaluation is necessary to adapt to the 21st century rich

digital information landscape. From the perspective of constructivism, the emphasis is in

constructing one's own meaning (Savolainen, 2009). Information processing is an

indispensable element of decision making, which is often a significant reason why we

search for information in the first place.

All three models of information literacy include a processing element, although

overlap with the picking process, as described above, is evident (see Table 1). Eisenberg &

Berkowitz (1990) see processing as judging the product and reflecting on the process of

searching. Kuhlthau (1991) points to exploration and formulation with an eye toward the

affective reactions of the individual searching for information. Neuman (2011) discusses

processing in considerable detail in his model by looking at evaluating the quality of

information, reflecting on and analyzing the information, and internalizing the information

gathered.

Perhaps the most noticeable omission in the three previous models is the social-

collaborative process of using and digesting information in a digital world. The range of

information tools available such as video, blogs, tweets, wiki, and social networking posts

(Mackey & Jacobson, 2011) can shift processing from an exclusive, individual constructivist

process, to a social constructivist process (O`Farrill, 2010; Savolainen, 2009). While

information may eventually be cognitively digested and processed by the individual mind,

the pathway to that processing is much different than it was 25 years ago. Multiple inputs

from many individuals and perspectives, which is characteristic of the digital world,

inevitably alters the manner in which information is processed.

      Producing. The fourth P in the 4Ps framework stands for *producing*. In previous

decades, the most frequent forms of presenting information were written documents

(Mackey & Jacobson, 2011). Relatively few individuals were able to formally publish and

present their work. This picture has changed markedly in the 21st century. Web 2.0 has

made it possible to readily and easily present information on a global scale through various

formats such as videos, blog entries, tweets, social networking sites, websites, and wikis

(Bawden, 2007; Eshet, 2012; Mills, 2010; Mackey & Jacobson, 2011; Ng, 2012; Spiranec &

Zorica, 2010). User-generated information can be produced individually or in

collaboration with others due to the affordances of participatory technologies. Wikipedia is

but one example of how Web 2.0 tools have altered the way that information is produced

collaboratively (Dunaway, 2011). All three previous models of information include a

production component including synthesis (Eisenberg & Berkowitz, 1990; Eisenberg,

2008), search closure (Kuhlthau, 1991) and communicating knowledge (Neuman, 2011).

These models, however, refer to more formal printed production and do not take into

account the wide variety of easy-to-use presentation formats available in the digital age

(see Table 1).

Dynamics of 4Ps Framework

      At first, the 4Ps framework, like previous models of information literacy, appears to

flow in a linear fashion from one stage to another. The information seeker forms a search

plan based on a problem, enacts that plan by locating and selecting needed information,

processes this information to determine accuracy, quality, and meaning, and finally uses

the information to produce a digital product. However, at least four key features of a digital environment precipitates non-linear interactions within the 4Ps framework.

First, the speed with which information can be gathered or automatically sent can catalyze rapid cycling among planning, picking, and processing. For example, planning is quickly altered by new, unexpected information selected or by critical analysis of information based on multiple perspectives in the processing stage.

Second, the enormous volume of information available in the digital world can rapidly alter search plans and picking strategies based on an inability to process the quagmire of data. Users need to be able to scale back the scope of planning and problems addressed, modify picking strategies, refine processing, and revise production when the range and breadth of information is too large. If the information seeker is not willing or able to nimbly jump among planning, picking, processing and producing, the effectiveness of any one stage could be severally limited by information overload.

Third, the nature of social interaction in Web 2.0 through the multitude of social media available can quickly alter plans, picking strategies, the quality of processing or the production of a final product causing the information seekers to revisit any one of the 4P stages.

Finally, the availability of easy-to-use, high quality, production tools can lead to rapid cycling among planning, picking, processing and producing. Information seekers can pursue this type of trial and error approach in the 4Ps framework. A plan can be developed based on a problem. Information is quickly found, selected, and processed. Finally a product is produced and evaluated by the individual and the social network. If significant

concerns or problems are noted, the information seekers can start the information literacy
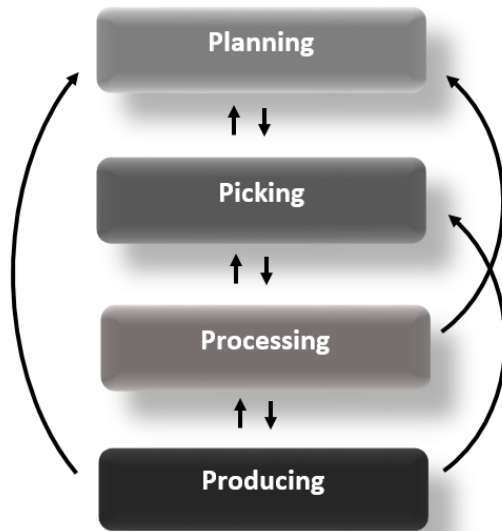
cycle again (Figure 1).

Figure 1. The 4Ps Framework of Information Literacy

Summary and Implications

After reviewing 50 peer-reviewed scholarly papers on information and digital

literacy in the last decade, from 2004 to 2014, the results reveal that digital information

literacy entails a number of complex knowledge, skills, and dispositions than had not

previously been envisioned. Six critical themes about information literacy were addressed

in this review: evolution, proposed definitions, foundational learning theories, new

literacies, digital literacy, and previous information literacy models.

Information literacy has progressed through at least five stages starting as a

problem-solving approach in business (Zurkowski, 1974), moving toward user education

in a library context (Pinto et al., 2010), merging with technological and communication

literacy (Pinto et al., 2010), returning to an expanded and more detailed version of problem

solving incorporating critical thinking and evaluation skills (Spiranec & Zorica, 2010), and

recently embracing communication and collaboration elements (Mokhtar et al., 2009). It is

worth considering unanticipated aspects of technology when predicting future stages of

evolution. For example, the rapid pace or "twitch-speed" at which technology is consumed

(e.g., Prensky, 2012) might significantly reduce the time spent in planning, picking,

processing and producing information and thereby altering the extent to which individuals

use higher level thinking skills such a critical thinking, evaluation, and collaboration.

Related to twitch speed are changes in reading habits of a new generation of information

consumers weaned on the Internet (e.g., Carr, 2011). Passages the length of a screen or less

(and that screen is becoming smaller) are now perceived as the optimal limit of

consumption. A shift in the propensity to read could have a marked impact on the

processing of information proposed in the 4Ps framework.

Proposed definitions of information have varied considerably. A number of

researchers maintain that these definitions have not adequately adjusted to new

understanding of knowledge in a digital environment (Makey & Jacobson, 2011; Sundin,

2008). Establishing a clear, concrete, relatively stable definition of information literacy

may be unattainable because of the rapidly changing parameters in ICT and the digital

world. Perhaps the best one can do is create a schema like the 4Ps framework (planning,

picking, processing and producing) to identify a general set of defining characteristics.

Three learning theories appear to have played a significant role in the domain of

information literacy: constructivism (e.g., Kuhlthau, 1991; Savolainen, 2009; Tuominen,

2005), social constructivism (e.g., Abdi et al., 2013; Farkas, 2012; O'Farrill, 2010) and

Bloom's Taxonomy (e.g., Andrae & Anderson, 2012; Kessinger, 2013; Spring, 2010).

However, at least three other perspectives may be influential in the future: problem-based learning (Boud & Feletti, 1997), communities of practice (Wenger, 2002), and connectivism (Siemens, 2005). All three fall in the social constructivist domain but address the digital environment by focussing on communication, collaboration, and open-ended problems that are better addressed by communities than the individual.

The notions of multi- and new literacies (Lankshear & Knobel, 2003; Ng, 2012) has re-focused information literacy from an individual endeavour to a social-collaborative process requiring proficiency in a number of modalities to succeed in a digital environment with constantly changing social contexts and an abundance of information .

Digital and information literacy appear to be inextricably linked. The skills needed to become competent in a digital world are often the same skills that are needed to be proficient at planning to find, picking, processing, and producing information. Similarly the skills required in digital literacy overlap with those required in information literacy. .

The Big Six (Esienberg & Berkowitz, 1990), ISP (Kuhlthau, 1991), and I-LEARN (Neuman, 2001) models provide a solid foundation for understanding information literacy. The 4Ps framework helps organize and compare different components of these models (Table 1) and provides an updated perspective incorporating the influence of digital tools and collaboration. The 4Ps framework also supports the idea of non-linear interactions among planning, picking, processing and producing (Figure 1).

Digital technologies have substantially altered the nature of interactions among various information literacy components. Picking is aided by a wealth of databases and supporting tools, but it is also hindered by potential excess of information that needs to be

evaluated and digested. Producing is facilitated by a wealth of organizational, easy-to-use tools that help disseminate information quickly and broadly in a wide range of alternative formats including wikis, websites, video podcasts and open-access journals (Mills, 2010).

Finally, it is worth noting that 70% of the articles reviewed for this paper are theoretical. While it is critical to consider the theoretical and philosophical perspectives of information literacy, empirical research is needed to back this theory with evidence. Key questions that need to be investigated in more detail include:

1. What are the key skills and abilities that have a significant impact on the informational literacy process?

2. How does digital literacy interact with information literacy in real-world settings?

3. How do key components of the 4Ps framework interact in practice?

4. How are the key components of information literacy fundamentally changed by the use of technology?

References

American Library Association (198). *Presidential committee on information literacy* - Final

   report. Chicago: American Library Association. Retrieved from

   http://www.ala.org/acrl/publications/whitepapers/presidential

Abdi, E. S., Partridge, H., & Bruce, C. (2013). Website designers: How do they experience

   information literacy? *The Australian Library Journal, 62 (1)*, 40-52. doi:

   10.1080/00049670.2013.771767

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching,*

   and assessing: A revision of Bloom's taxonomy of educational objectives. Boston, MA:

   Allyn & Bacon.

Andreae, J., & Anderson, E. L. (2012). Re-conceptualizing access: The new role of

   information literacy in post-secondary education. *Communications in Information*

   Literacy, 5(2), 74-81.

Badke, W. (2010). Foundations of information literacy: Learning from Paul Zurkowski.

   Online, 34(1), 48-50.

Bawden, D. (2001). Information and digital literacies: A review of concepts. *Journal of*

   Documentation, 57(2), 218-259. doi:10.1108/EUM0000000007083

Bawden, D. (2007). Towards Curriculum 2.0: library/information education for a Web 2.0

   world. *Library and information Research*, *31*(99), 14-25.

Bawden, D., & Robinson, L. (2009). The dark side of information: Overload, anxiety and

   other paradoxes and pathologies. *Journal of Information Science, 35*(2), 180-191.

   doi:10.1177/0165551508095781

Beeson, I. (2006). Judging relevance: a problem for e-literacy. *Innovation in Teaching and Learning in Information and Computer Sciences*, *5*(4), 210-219. doi: 10.11120/ital.2006.05040210

Bilal, D., & Bachir, I. (2007). Children's interaction with cross-cultural and multilingual digital libraries. II. Information seeking, success, and affective experience. *Information Processing and Management, 43*(1), 65-80. doi:10.1016/j.ipm.2006.05.008

Bloom, B. S. (1956). *Taxonomy of educational objectives*. Vol. 1: Cognitive domain. New York: McKay.

Boud, D., & Feletti, G. (1997). *The challenge of problem-based learning* (2nd ed.). London: Kogan Page.

Bruce, C.S. (1997). *The seven faces of information literacy*. Adelaide: Auslib Press.

Bruce, C. S. (2004). Information literacy as a catalyst for educational change. A background paper. Lifelong learning: whose responsibility and what is your contribution? *3rd International Lifelong Learning Conference*, Yeppoon, Queensland, Australia.

Bruce, C., Edwards, S., & Lupton, M. (2006). Six frames for information literacy education: A conceptual framework for interpreting the relationships between theory and practice. *Innovation in Teaching and Learning in Information and Computer Sciences*, *5*(1), 1-18. doi:10.11120/ital. 2006.05010002

Bruce, C. (2008). *Informed learning*. Chicago: College and Research Libraries, American Library Association.

Cahoy, E. (2013). Affective learning and personal information management: essential components of information literacy. *Communications in Information Literacy, 7*(2), 146-149.

Carr, N (2011). *What the Internet is doing to our brains: The shallows*. New York: W.W. Norton & Company, Inc.

Davis, B., & Sumara, D. (2002). Constructivist discourses and the field of education: Problems and possibilities. *Educational Theory, 52*(4), 409. doi: 10.1111/j.1741-5446.2002.00409.x

Doherty, J. J., & Ketchner, K. (2005). Empowering the intentional learner: A critical theory for information literacy instruction. *Library Philosophy and Practice, 8*(1), 1-8.

Dunaway, M. (2011). Web 2.0 and critical information literacy. *Public Services Quarterly, 7*(3-4), 149-157. doi:10.1080/15228959.2011.622628

Eisenberg, M. B., & Berkowitz, R. E. (1990). *Information problem-solving: the Big Six Skills approach to library & information skills instruction*. Norwood, NJ: Ablex.

Eisenberg, M. (2008). Information literacy: Essential skills for the information age. DESIDOC. *Journal of Library & Information Technology*, *28*(2), 39-47. doi: 10.14429/djlit.28.2.166

Elmborg, J. (2006). Critical information literacy: Implications for instructional practice. *The Journal of Academic Librarianship*, *32*(2), 192-199. doi:10.1016/j.acalib.2005.12.004

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia & Hypermedia, 13*(1), 93-106.

Eshet, Y. (2012). Thinking in the digital era: A revised model for digital literacy. *Issues in Informing Science & Information Technology, 9*, 267-273. Retrieved from http://iisit.org/Vol9/IISITv9p267-276Eshet021.pdf

Farkas, M. (2012). Participatory technologies, pedagogy 2.0 and information literacy. *Library Hi Tech, 30*(1), 82-94. doi:10.1108/07378831211213229

Garner, S. D. (2006). High-level colloquium on information literacy and lifelong learning. Bibliotheca Alexandrina, Alexandria, Egypt. Retrieved from http://www.ifla.org/files/assets/information-literacy/publications/high-level-colloquium-2005.pdf

Gilster, P. (1997). *Digital Literacy*. New York: Wiley Computer Publishing.

Gorrell, G., Eaglestone, B., Ford, N., Holdridge, P., & Madden, A. (2009). Towards "metacognitively aware" IR systems: An initial user study. *Journal of Documentation, 65*(3), 446-469. doi:10.1108/00220410910952429

Jeffrey, L., Hegarty, B., Kelly, O., Penman, M., Coburn, D., & McDonald, J. (2011). Developing digital information literacy in higher education: obstacles and supports. *Journal of Information Technology Education: Research*, *10*(1), 383-413.

Jones, K. (2007). Connecting social technologies with information literacy. Journal of Web Librarianship, *1*(4), 67-80. doi:10.1080/19322900802111429

Julien, H., McKechnie, L. E. F., & Hart, S. (2005). Affective issues in library and information science systems work: A content analysis. *Library and Information Science Research, 27*(4), 453-466. doi:10.1016/j.lisr.2005.08.004

Keene, J., Colvin, J., & Sissons, J. (2010). Mapping student information literacy activity against Bloom's Taxonomy of cognitive skills. *Journal of Information Literacy*, *4*(1), 6-21. doi: 10.11645/4.1.189

Kessinger, P. (2013). Integrated instruction framework for information literacy. *Journal of Information Literacy*, 7(2), 33-59. doi:10.11645/7.2.1807

Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's

    perspective. *Journal of the American Society for Information Science, 42*(5), 361-371.

Kuhlthau, C. C., Heinström, J., & Todd, R. J. (2008). The 'information search process'

    revisited: is the model still useful? *Information Research*, *13*(4). Retrieved from

    http://www.informationr.net/ir/13-4/paper355.html

Lankshear, C. & Knobel, M. (2003). *New literacies: Changing knowledge and classroom*

    learning. Buckingham, UK: Open University Pres.

Lankshear, C., & Knobel, M. (2011). *New literacies*. New York, NY: McGraw-Hill

Lloyd, A. (2005). Information literacy. *Journal of Librarianship and Information Science,*

    37(2), 82-88. doi:10.1177/0961000605055355

Lloyd, A. (2007). Learning to put out the red stuff: Becoming information literate through

    discursive practice. *The Library Quarterly, 77*(2), 181-198.

Lloyd, A. (2010). Framing information literacy as information practice: Site ontology and

    practice theory. *Journal of Documentation, 66*(2), 245-258.

    doi:10.1108/00220411011023643

Lloyd, A. (2012). Information literacy as a socially enacted practice: Sensitising themes for

    an emerging perspective of people-in-practice. *Journal of Documentation, 68*(6), 772-

    783. doi:10.1108/00220411211277037

Lloyd, A., Kennan, M. A., Thompson, K. M., & Qayyum, A. (2013). Connecting with new

    information landscapes: Information literacy practices of refugees. *Journal of*

    Documentation, 69(1), 121-144. doi:10.1108/00220411311295351

Lopatovska, I., & Mokros, H. B. (2008). Willingness to pay and experienced utility as

    measures of affective value of information objects: Users' accounts.*Information*

    processing & management, *44*(1), 92-104. Doi:10.1016/j.imp/2007.01.020

Mackey, T. R., & Jacobson, T. E. (2011). Reframing information literacy as a metaliteracy.

    College & Research Libraries, 72(1), 62-78.

Matteson, M. L. (2014). The whole student: Cognition, emotion, and information literacy.

    College & Research Libraries, 75(6), 862-877. doi:10.5860/crl.75.6.862

Mills, K. (2010). A review of the "Digital turn" in the new literacy studies. *Review of*

    Educational Research, 80(2), 246-271. doi:10.3102/0034654310364401

Mokhtar, I. A., Foo, S., Majid, S., Yin, L. T., Luyt, B., & Yun-Ke Chang. (2009). Proposing a 6+3

    model for developing information literacy standards for schools: A case for Singapore.

    Education for Information, 27(2), 81-101. doi:10.3233/EFI-2009-0877

Morgan, P. K. (2014). Information literacy learning as epistemological process. *Reference*

    Service Review, 42(3), 403-413. doi:10.1108/RSR-04-2014-0005

Nahl, D. (2001). A conceptual framework for explaining information behavior. *Studies in*

    Media & Information Literacy Education, 1(2). Retrieved from

    http://www2.hawaii.edu/~donnab/lis610/nahl_2001.html

Neuman, D. (2011*). Learning in information-rich environments: I-LEARN and the*

    construction of knowledge in the 21st century. New York, NY: Springer

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, *59*(3)

    1065-1078. doi:10.1016/j.compedu.2012.04.016

O'Farrill, R. T. (2010). Information literacy and knowledge management at work:

Conceptions of effective information use at NHS24. *Journal of Documentation, 66*(5),

706-733. doi:10.1108/00220411011066808

Pinto, M., Cordón, J., & Gómez Díaz, R. (2010). Thirty years of information literacy (1977—

2007). *Journal of Librarianship and Information Science, 42*(1), 3-19.

doi:10.1177/0961000609345091

Prensky, 2012. *From digital natives to digital wisdom*. Thousand Oaks, CA: Corwin.

Rebmann, K. (2013). A review of literacy frameworks for learning environments design.

Learning Environments Research, 16(2), 239-257. doi:10.1007/s10984-013-9132-z

Rockman, I. F. (2002). Strengthening connections between information literacy, general

education, and assessment efforts. *Library Trends, 51*(2), 185-198.

Saranto, K., & Hovenga, E. J. S. (2004). Information literacy—what it is about? *International

Journal of Medical Informatics, 73*(6), 503-513. doi: 10.1016/j.ijmedinf.2004.03.002

Savolainen, R. (2009). Information use and information processing. *Journal of

Documentation, 65*(2), 187-207. doi:10.1108/00220410910937570

Schroeder, R. & Cahoy, E. S.(2010). Valuing information literacy: Affective learning and the

ACRL standards. *Libraries and the Academy 10*(2), 127-146. doi: 10.1353/pla.0.0096

Siemens, G. (2005). Connectivism: A learning theory for the ages. *International Journal of

Instructional Technology and Distance Learning, 2*(1), 3-10.

Spring, H. (2010). Learning and teaching in action. *Health Information and Libraries Journal*,

27, 327-331, doi: 10.1111/j.1471-1842.2010.00911.x

Špiranec, S., & Zorica, M. B. (2010). Information literacy 2.0: Hype or discourse refinement?

Journal of Documentation, 66(1), 140-153. doi:10.1108/00220411011016407

Sundin, O. (2008). Negotiations on information-seeking expertise. *Journal of Documentation, 64*(1), 24-44. doi:10.1108/00220410810844141

Tapscott, D. (2009). *Grown up digital: How the net generation is changing your world*. New York: McGraw-Hill.

Tuominen, K., Savolainen, R., & Talja, S. (2005). Information literacy as a sociotechnical practice. *The Library, 75*(3), 329-345.

Wen, J. R., & Shih, W. L. (2008). Exploring the information literacy competence standards for elementary and high school teachers. *Computers & Education*, *50*(3), 787-806. doi: 10.1016/j.compedu.2006.08.011

Wenger, E. (2002). Cultivating communities of practice. Boston: Harvard Business Review Press.

Wilder, S. (2005). Information literacy makes all the wrong assumptions. *Chronicle of Higher Education, 51*(18), B13.

Williamson, K. (2006). Research in constructivist frameworks using ethnographic techniques. *Library Trends, 55*(1), 83-101. doi: 10.1353/lib.2006.0054

Zurkowski, P. (1974). *The Information Service Environment: Relationships and Priorities*. Washington DC: National Commission on Libraries and Information Science, ERIC Clearinghouse on Information Resources. ED 100391. Retrieved from http://files.eric.ed.gov/fulltext/ED100391.pdf

Appendix A – List of Article Reviewed

Authors	Population	Type	Description
Abdi et al., 2013	Workplace	Qualitative	Maps variation in experiencing the phenomenon of information literacy from the viewpoint of website designers.
Andreae & Anderson, 2012	Academic	Theoretical	Proposes a new conceptual model where information literacy plays a vital role in understanding and using information.
Badke, 2010	Academic	Theoretical	Discusses why information literacy should be emphasized more in higher education.
Bawden & Robinson, 2009	Academic	Theoretical	Reviewed key issues regarding the communication of information including overload and anxiety.
Bawden, 2007	Academic	Theoretical	Reports an international comparison of changes in library/information curricula.
Beeson, 2006	Academic	Theoretical	Considers how information can be judged relevant, and what information literacy means in the context of the Web.
Bilal & Bachir, 2007	Academic	Mixed	Investigates Arabic-speaking children's interaction with the International Children's Digital Library (ICDL).
Bruce, 2004	Academic	Theoretical	Reviewed key models of information literacy in the education
Bruce, 2008	Academic	Theoretical	Proposes the need for teaching and learning to bring about new ways of experiencing and using information.
Bruce et al. (2006)	Academic	Theoretical	Proposes the Six Frames for Information Literacy Education.
Cahoy, 2013	Academic	Theoretical	Proposes that we must approach information literacy as an emotional and ultimately rewarding process.
Chang, et al.,2012	Academic	Survey	TA study examining the information literacy level of secondary school students in Singapore
Doherty & Ketchner, 2005	Academic	Theoretical	Presents critically grounded theory of information literacy instruction.

Dunaway, 2011	Workplace	Theoretical	Argues that Web 2.0 presents challenges to librarians through positioning students as active creators of knowledge rather than passive consumers.
Eisenberg, 2008	Academic	Theoretical	Overview of IL focusing on three contexts for successful IL: information process, technology in context, and implementation of real needs.
Elmborg, 2006	Academic	Theoretical	Uses critical literacy theory to define information literacy and argues that librarians must focus on developing critical consciousness in students.
Eshet, 2012	Academic	Theoretical	Presents an updated version of the skills-based theoretical framework, adding to it a sixth skill (real-time thinking skill)
Eshet-Alkalai, 2004	Academic	Theoretical	Proposes new conceptual framework of digital literacy that includes photovisual, reproduction, information, branching and socio-emotional literacy.
Farkas, 2012	Academic	Theoretical	Explores the impact participatory technologies have had on education and the information environment in which students operate.
Gorrell et al., 2008	Academic	Survey	Describes a new taxonomy of metacognitive skills designed to support the study of metacognition in the context of web searching.
Jeffery et al., 2011	Academic	Mixed	Identifies obstacles and supports that influence the development of digital information literacy in staff and students in the tertiary education sector.
Jones 2007	Academic	Theoretical	Explores social technologies and suggests they could build higher-order thinking skills outlined in various IL frameworks, particularly in an educational context.
Julien et al., 2005	Academic	Review	Reviews systems work in library and information science to determine the relative interest in affective issues being shown.
Keene et al., 2010	Academic	Theoretical	Introduces framework of information literacy which maps the activities that students undertake against Bloom's taxonomy of cognitive skills.
Kessinger, 2013	Academic	Qualitative	Case study about how a model for a developmental approach to IL was initiated at a large American undergraduate institution.
Kuhlthau, et al., 2008	Academic	Mixed	Discusses the users' perspective of information seeking.
Lloyd et al., 2013	General Life	Qualitative	Examines how refugees learn to engage with a complex, multimodal information landscape.
Lloyd, 2005	Workplace	Qualitative	Explored the meaning and role of information literacy among a specific group of workers – firefighters.

Lloyd, 2007	Workplace	Qualitative	Supports new definition of information literacy that recognizes information literacy as a way of knowing and more just the acquisition of skills and attributes.
Lloyd, 2010	Workplace	Theoretical	Explores information literacy as sociocultural practice.
Lloyd, 2012	Workplace	Theoretical	Introduces a shift in focus from information literacy skills towards information literacy as a socially enacted practice.
Lopatovska & Mokros, 2008	Workplace	Theoretical	Discusses two measures of affective value of information objects: Willingness-to-Pay (WTP) and Experienced Utility (EU).
Mackey & Jacobson, 2011	Academic	Theoretical	Introduces meta-literacy framework focusing on producing and sharing information not just searching for information.
Matteson, 2014	Academic	Survey	Examines how two emotional constructs (emotional intelligence and dispositional affect) and two cognitive constructs (motivation and coping skills) interacted with students' information literacy scores.
Mills, 2010	Academic	Review	Reviews a decade of empirical work of the new literacy studies, identifying the shift toward research of digital literacy applications.
Mokhtar et al., 2009	Academic	Theoretical	Proposes model to develop IL standards for schools in Singapore based on the Big Six Model
Morgan, 2014	Academic	Theoretical	Discusses reasons for an approach to teaching IL which emphasis higher-order intellectual concerns.
Ng, 2012	Workplace	Survey	Investigates knowledge about educational technologies by undergraduate students and how they adopt unfamiliar technologies into their learning.
O'Farrill, 2010	Workplace	Qualitative	Explores theoretically and empirically the concept of workplace information literacy (IL) and its connections to knowledge management.
Pinto et al., 2010	Academic	Review	Provides review of information literacy and its evolution over the last 30 years.
Rebmann, 2013	General Life	Theoretical	Charts the development of three literacy research frameworks: multiliteracies, new literacies, and popular literacies.
Saranto & Hovenga, 2004	Workplace	Review	Reviews literature focusing on the concept of information literacy in the field of health, nursing and medical informatics.
Savolainen, 2009	Academic	Theoretical	Discusses the process of information use by comparing the constructivist and human information processing approach.
Schroeder & Cahoy, 2010	Academic	Theoretical	Proposes a model for affective-focused higher education information literacy standards.

Spiranec & Zorica, 2010	Academic	Theoretical	Introduces the term Information Literacy 2.0 as a subset of information literacy providing an outline of theoretical assumptions.
Spring, 2010	Academic	Theoretical	Integrates Bloom's taxonomy and the SCONUL seven pillars of information literacy,
Sundin, 2008	Academic	Qualitative	Examines how different approaches to information literacy are used as tools in negotiating the information-seeking expertise of university librarians.
Tuominen et al., 2005	Workplace	Theoretical	Views IL as a sociotechnical practice and how individuals interact with other people and with technical artifacts.
Wen & Shih, 2006	Workplace	Survey	Establishes information literacy competence standards for elementary and high school teachers.
Wilder, 2005	Academic	Theoretical	Examines the complexity of information retrieval by librarians.