Metacognition: Information Literacy and Web 2.0 as an Instructional Tool
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Abstract
Web 2.0’s consistently evolving capabilities and features present a daunting task for educators as an instructional tool because of the educators’ limited technological abilities or time constraints. Although Web 2.0 assists educators with guiding learners to complete tasks and supports the scaffolding of lessons to meet course objectives, there are more advanced pedagogical implications when using Web 2.0 as an instructional tool, such as fostering information literacy and metacognition. This article reviews information literacy standards and the use of Web 2.0 as an effective instructional tool to develop the metacognitive skills required to empower learners to use Web 2.0 responsibly, both in the classroom and on their own. Adaptations of Bloom’s Digital Taxonomy and Salmon’s chart of online competency are included in this article to serve as guides for supporting the metacognitive framework of information literacy and Web 2.0 in the educational setting.

Keywords
Web 2.0, metacognition, information literacy

Introduction
Web 2.0 is an example of an online communication technology that has created new forms of literacy with its consistently evolving features and capabilities to produce and manipulate information (Baron, 1999). Web 2.0 is a term used to describe cultural trends like social networking, blogging, podcasting, and streaming media; it describes a landscape in which users control their online experience and influence the experiences of others (Funk, 2009). In response to the widespread adoption of online interactive environments and social networking opportunities, pedagogies have evolved that take advantage of Web 2.0’s emphasis on creation and connectivity (McLoughlin & Lee, 2008).

Today, teaching has transitioned from Web 1.0 (which centered primarily on the simple retrieval of information) to the dynamic user-centered Web 2.0 (Pegrum, 2009). This transition has important cognitive and epistemological implications. Web 2.0 has influenced a generation of students that prefers speed and interactivity; it is a generation that not only wants to access infor-
Web 2.0 and Education

The classroom is where students are guided and provided with the essential tools to develop important literacy skills. Web 2.0 in education is based on holistic elements, such as developing mental models and value systems as a result of life experiences and highly generalized learning principles. (Ford, 2008; Stolovich & Keeps, 2002). Web 2.0 in the classroom can be used to influence the social context of students’ lives outside of the classroom (Cortes, 1986) and to develop responsible citizens who use online resources for self-empowerment and community building. Education has always been concerned with community and society as a whole; in the early days of the North America, the school was a “means of internal cohesion” to instill the community’s religious beliefs and cohesion (Mitchell, 2005, p. 647). Today, Web 2.0 expands and redefines community; it can open up opportunities and communities if it is used responsibly. In this sense, Web 2.0 in education upholds a sense of cohesion and supports the objectives of society’s demands.

In the classroom, students are able to internalize course content by using Web 2.0 to simulate the students’ real life social experiences. Engagement is an essential part of the learning process in that it offers students opportunities to interact meaningfully with course content, and to provide and receive feedback from their peers. It is a method of developing self-conceptions that foster the transfer of the new knowledge and mental models to the social context outside of the classroom (Freeman & Freeman, 2001).

Web 2.0 pedagogies are student-centered approaches that in response to the cultural and literacy demands of the information age, educators have begun to alter their pedagogical approaches to align with their students’ culture. Although Web 2.0 resources are familiar to today’s learners, there are pedagogical implications beyond interactivity and student-centered engagement. As an instructional tool, Web 2.0 assists
educators with guiding learners to complete tasks and supports the scaffolding, or step-by-step structuring, of instructional tasks (see Vygotsky, 1978), to develop students’ retention of course content in a familiar environment (Halverson, 2009).

Despite our students’ familiarity with and avid use of technology, education plays an important role in the development of specific cognitive skills and fosters other essential competencies for the individual learner’s effective use of Web 2.0. Reading and writing are two basic competencies; with the vast variety of information accumulated and disseminated with Web 2.0, the practice of reading and writing has evolved, developing new genres and modes that require additional metacognitive skills. Web 2.0 has influenced society with a "new way of communicating, making meaning, being understood, expressing a sense of self and connecting with others. Its growing range of technologies provides us with choices that allow for sophisticated visual, auditory, graphic and digital representation which require new understanding of how messages are sent, received, stored, replicated and reshaped" (Baguley, Pullen, & Short, 2010, p. 4). In turn, it can be argued that the new generation of learners’ adaptation of technology into their culture has affected the way they think and process information (Prensky, 2001a).

When educators incorporate Web 2.0 within their classrooms, an opportunity is created to formalize students’ existing social online behavior and practices and encourage them to enhancing their thinking processes. Students must develop the information-processing skills necessary to constructively contribute and effectively make use of the rapid exchange of information via Web 2.0. These skills must foster students’ ability to transfer knowledge and consistently deconstruct ideas to develop new knowledge (Ford, 2008). This is the basic principle of metacognition—the ability to transfer and build knowledge in other areas during the learning process. Metacognition entails the ability to control how one learns to expand one’s knowledge base (Ford, 2008). The student plans how to approach the task at hand and selects various skills to execute the task by making associations with prior knowledge. As they complete their tasks, they obtain new knowledge and adjust prior analogies and mental images. At this stage, the students continue the cycle of the following metacognitive activities until the task is fully completed: planning, strategizing, making connections with prior knowledge, monitoring, regulating, and evaluating their own progress (Flavell, 1979; Sternberg, 1998; Stolovich & Keeps, 2002).

Metacognitive development is most effective when students are motivated by information that interests them or is facilitated within a familiar or stimulating instructional environment. With Web 2.0 resources, educators now can foster learning situations that reflect both the curriculum and individual learning styles (Beard, 2008) and that “foster[s] interaction in which learners share responsibility for their own learning” (Artzt & Armour-Thomas, 1998, p. 21). This is an effective method for the development of autonomous and versatile learners who are aware of their own limitations and learning process (Ford, 2008). The ultimate goal of Web 2.0-based education, then, is to influence students to become aware of their own learning styles and capabilities (versatility) and minimize their dependence on pedagogical mediation (autonomy) and develop conscious strategies (metacognition) (Ford, 2008).

Web 2.0 as Part of the Curriculum

Most new communication technologies go through a number of stages, starting with a limited range of communication opportunities (such as the presentational model of Web 1.0) to the transactional opportunities of Web 2.0. At the stage when Web 2.0 became accessible and functional across the general population, a new literacy spread. No longer restricted by Web 1.0’s pas-
sive modes of communication, Web 2.0 has successfully created new forms of knowledge creation and connectivity, such as wikis and interactive blogs (Baron, 1999). This has affected how users analyze, gather, use, and disseminate information, thus establishing information literacy as a required key skill for twenty-first century students.

Literacy has a variety of definitions and meanings, almost all of which are associated with the most positive aspects of community, and encompasses a wide variety of attitudes, beliefs and power relations between individuals and groups. Functional literacy is the ability to read and write and the ability to use literacy for practical purposes (Blake & Blake, 2005). The most common meaning of literacy today centers on the basic ability to read and write at a functional level (Baguley, Pullen, & Short, 2010). The level of these abilities evolve as the demands and culture in society evolves; social and cultural conventions shape a particular literacy (Utsi & Lowyck, 2005). While years ago local expectations defined literacy standards, today’s global economy, which is also known as the “knowledge or innovation” economy, has broadened the standards of literacy with the same evolving consistency as the new transactional tools on Web 2.0.

The ability to read and write text has evolved to the ability to read and write information (Baguley, Pullen, & Short, 2010). In Web 2.0 environments, information can be produced in diverse media and be redefined as hypertext—online materials that are linked together by individual bits of text or whole documents. These opportunities have shaped the ways we read, write, and teach, as well as how we conceive of text itself (Charney, 1994). Web 2.0 has created a new form of literacy, arising out of such sources as 140-character long tweets and collaboratively authored wikis. The information published on Web 2.0 enables users to control their online experience and influence the experiences of others. As chief information architects, users have independently developed habits that can be enhanced through educational mediations.

Information literacy has been described as a broad range of information processing skills (Utsi & Lowyck, 2005). Along with learning course content, information literacy is also the desired learning outcome that entails metacognitive activities. According to the Association of College and Research Libraries (2000), information literacy includes the ability to:

- Determine the extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically
- Incorporate selected information into one’s knowledge base
- Use information effectively to accomplish a specific purpose
- Understand the economic, legal and social issues surrounding the use of information, and access and use information ethically and legally. (ACRL, 2000, p. 2-3)

Largely due to the impact of Web 2.0, information literacy has become an integral part of the curriculum, in which every subject must incorporate information literacy as a key competency. Since Web 2.0 is consistently evolving, it is the ideal classroom tool in that it grants students the “opportunity for self-directed learning; it encourages them to become engaged through the use of a wide variety of information sources to expand their knowledge, ask informed questions, and sharpen their critical thinking for still further self-directed learning” (ACRL, 2000, p. 9).

As stakeholders of information literacy, academic librarians organized through the Association of College and Research Libraries have established information literacy standards that have been adapted by higher educational institutions to support the ability of educators to enhance the information needs of higher education (ACRL, 2011). Table 1 couples correspond-
ing metacognitive activities with ACRL’s information literacy standards when using Web 2.0. Educators are encouraged to

use these standards as indicators of students’ information literacy development, and in turn, learners learn to gain control over how they interact with information, sensitizing them to the need to develop a metacognitive approach to learning, making them conscious of the explicit actions required for gathering, analyzing, and using information. (ACRL, 2000, p. 6)

Since the gathering, analysis, and use of information varies from discipline to discipline, educators can apply these standards within the context of their course content.

Table 2, which is an adaptation of Andrew Churches’ Bloom’s Digital Taxonomy, links cognitive processes with Web 2.0 tools. This table enables teachers and students to monitor different cognitive strategies with Web 2.0 tools. Andrew Churches’ Digital Taxonomy correlates the different Web 2.0 tools and features with cognitive skills charted in the original Bloom’s Taxonomy Higher Thinking Order. Churches uses transitive verbs to represent the active cognitive processes when using Web 2.0 tools as opposed to Bloom’s Taxonomy, which uses nouns to classify the thinking processes required by the activity; interestingly, this shift in language use can be regarded as indicative of how Web 2.0 inspires active cognitive processes. In Web 2.0 classrooms, students are able to refine and enhance such cognitive processes. The simpler the Web 2.0 function, the lower the thinking skill; when using this chart, educators can discern and scale instructional tasks to develop students’ metacognitive skills. Both Tables 1 and 2 overlap because metacognition refers to the higher order of thinking, in which learners control the cognitive process in their learning (Ford, 2008). These tables highlight the metacognitive

<table>
<thead>
<tr>
<th>Metacognitive activity</th>
<th>ACRL Information Literacy Standards</th>
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<tbody>
<tr>
<td>Planning</td>
<td>Defines and articulates the need for information or platform to disseminate information</td>
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<tr>
<td>Selecting</td>
<td>Student accesses and contributes appropriate information needed effectively and efficiently</td>
</tr>
<tr>
<td>Connecting</td>
<td>Student evaluates information and its source critically and incorporates selected information into his or her knowledge base and value system</td>
</tr>
<tr>
<td>Regulating</td>
<td>Student, individually or as a member of a group, uses and contributes information effectively to accomplish a specific purpose</td>
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<tr>
<td>Evaluating</td>
<td>Student understands many of the ethical, legal and socio-economic issues surrounding information and information technology</td>
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*Table 1 – Metacognitive activities synchronous with information literacy standards*
<table>
<thead>
<tr>
<th>Bloom’s Taxonomy</th>
<th>Bloom’s Revised Taxonomy</th>
<th>Web 2.0 Tool Capabilities</th>
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<tbody>
<tr>
<td>Higher Order Thinking Skills</td>
<td>Terms</td>
<td></td>
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<tr>
<td>Evaluation</td>
<td>Creating</td>
<td>Designing, constructing, planning, producing, inventing, devising, making</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Evaluating</td>
<td>Checking, hypothesizing, critiquing, experimenting, judging, testing, detecting, monitoring commenting, reviewing, posting, moderating, collaborating, networking, reflecting, validating</td>
</tr>
<tr>
<td>Analysis</td>
<td>Analyzing</td>
<td>Comparing, organizing, deconstructing, attributing, outlining, finding, structuring, integrating</td>
</tr>
<tr>
<td>Application</td>
<td>Applying</td>
<td>Implementing, carrying out, using, executing</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understanding</td>
<td>Interpreting, summarizing, inferring, paraphrasing, classifying, comparing, explaining, exemplifying</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Remembering</td>
<td>Recognizing, listing, describing, identifying, retrieving, naming, locating, finding</td>
</tr>
<tr>
<td>Lower Order Thinking Skills</td>
<td></td>
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</tbody>
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*Table 2 – Web 2.0 tool capabilities according to Bloom’s Digital Taxonomy*
activities in play when students use Web 2.0 to foster their information literacy skills.

**Metacognition: The Desired Learning Outcome**

As a prerequisite for success in today’s connected and transactional world, educators should aim to foster learner autonomy, which makes students more independent and self-regulating in their education, and in turn enhances their abilities to increase their metacognitive knowledge and skills (Ford, 2008). A Web 2.0 student-centered approach motivates and enables students to take responsibility for their education, allowing them to determine whether they understand the content, whether the content is what they need, and what they still need to know and learn (Valenti, 2008). Educators are the agents who provide learners with guidance to develop the essential skills to become successful autonomous learners.

When using Web 2.0, the objective of education is not to make the students consistently reproduce the same mechanical strategies without variation (Ford, 2008; Stolovich & Keeps, 2002). Similarly, providing students with general instruction about Web 2.0 is not helpful because instruction is not connected to the specifics that are intended to be taught (Ford, 2008; Stolovich & Keeps, 2008). It is difficult to make broad assumptions about Web 2.0 pedagogies because they are constantly evolving. The main goal of Web 2.0 pedagogies, then, is to emphasize general mental models and value systems that can be applied in many different situations (Ford, 2008; Stolovich & Keeps, 2002). The broader function of Web 2.0 pedagogies is that when a student learns, the transformative outcomes are desirable for both the learner and society (Stolovich & Keeps, 2002).

While educators do not have to incorporate all of the options associated with Web 2.0, they should organize and administer stratified systems of opportunity and access to raise the literacy stakes in struggles for competitive advantage (Brandt, 1998). When teachers embrace Web 2.0 pedagogies and implement them creatively in the classroom, they are applying a student-centered approach to developing students’ information literacy and metacognitive skills in light of the information age. However, many educators are intimidated by Web 2.0 because it is constantly evolving and its rush of new features may make it hard for them to stay current.

Web 2.0 pedagogies are based on the premise that teachers are mediators who help students solve problems and find new solutions. As teachers sequence learning opportunities to promote the students’ information literacy skills, students can contribute to the planning of the instructional tasks by recommending Web 2.0 interfaces that would be useful to enhance and support the educational process (Freeman & Freeman, 2001; Pegrum, 2009). Ideally, teachers should participate with their students as they try out different Web 2.0 tools. With modest goals and the occasional use of Web 2.0 tools, the educators and students can share critical learning situations together. Overall, educators should focus on the key learning outcome of developing metacognitive skills so that their students can become more information-literate.

The rapid pace of Web 2.0 development requires that teachers and students filter obsolete information very fast. This can cause information overload, in which learners and educators are unable to complete the tasks at hand or procrastinate because they have experienced cognitive overload and cannot process any more information (Benito-Ruiz, 2009). This, coupled with focusing on metacognitive values, can cause a lot of over-thinking. In the classroom, time management and carefully sequenced lessons are critical, as is monitoring students’ metacognitive activities (Sternberg, 1998). For educators not familiar with Web 2.0, Table 3 is a rubric that serves as a guide for assessing and monitoring learners’ conduct and competencies with using Web
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<tbody>
<tr>
<td>Understanding of online process</td>
<td>Flexible in approaches to learning. Receptive to the challenge of online learning</td>
<td>Able to build online trust &amp; purpose with others. Understands role in online learning &amp; role as part of online groups</td>
<td>Participates in discussions, references and makes inferences with course content and prior knowledge, works through challenges, &amp; monitors understanding</td>
<td>Knows how to keep up with pace of discussions &amp; use time online</td>
<td>Able to explore ideas, develop arguments, make valuable contributions to threads</td>
<td>Able to adjust learning style to use range of approaches from structured activities (e-activities)</td>
</tr>
<tr>
<td>Technical skills</td>
<td>Operational understanding of Web 2.0 tool; able to access the Internet</td>
<td>Able to identify basic structures of Web 2.0 tools as potential for learning</td>
<td>Knows how to use special features of software. Uses Web 2.0 tools productively without consuming inordinate amounts of personal time</td>
<td>Able to use special features of software to explore and build knowledge</td>
<td>Able to make links between online &amp; other features of learning programs</td>
<td>Able to use Web 2.0 facilities to create &amp; manipulate information &amp; to generate an online learning environment; able to use alternative software &amp; platforms</td>
</tr>
<tr>
<td>Online communication skills</td>
<td>Courteous &amp; respectful in online (written) communication, able to keep up with pace &amp; use time appropriately</td>
<td>Able to write concise, energizing, and informative online messages</td>
<td>Able to engage online with people (not the machine or the software), be appropriately “visible” online, and meet the educational goals of the forum.</td>
<td>Able to interact through e-mail &amp; conferencing &amp; achieve interaction with others</td>
<td>Able to value diversity with cultural sensitivity, explore differences &amp; meanings</td>
<td>Able to communicate comfortably without instructional cues</td>
</tr>
<tr>
<td>Content expertise</td>
<td>Willing to share and contribute to knowledge &amp; experience</td>
<td>Able to make sound contributions</td>
<td>Able to debate by responding to intriguing questions and comments</td>
<td>Accountable for participation &amp; contributions</td>
<td>Able to value diversity with cultural sensitivity, explore differences &amp; meanings</td>
<td>Able to enliven conferences through use of multimedia &amp; electronic resources; and able to build on ideas</td>
</tr>
<tr>
<td>Personal Characteristics</td>
<td>Determined &amp; motivated to participate</td>
<td>Able to establish an online identity</td>
<td>Able to follow new educational contexts and learning methods; adapts to audiences &amp; roles</td>
<td>Shows sensitivity to online relationships &amp; communication</td>
<td>Shows a positive attitude, commitment &amp; enthusiasm for online learning</td>
<td>Knows how to participate as an active member in relevant online learning community</td>
</tr>
</tbody>
</table>

*Table 3 – Rubric for assessing learners’ Web 2.0 conduct and capabilities*
Web 2.0 is a dynamic instructional tool that supports learners’ information literacy skills which relies on metacognitive activities. Educators have to take on the role as mediators and guides in the instructional setting to prepare learners for the autonomous use of Web 2.0. When introduced to rubrics and learning objectives of the Web 2.0 tools, educators and learners are able to monitor the learners’ information literacy and metacognitive development.

As technology evolves, so will the standards and classifications of literacy. Web 2.0 is currently transitioning to Web 3.0, which is less user-centered and more technology centered. This transition will also affect how information is read, written, and distributed, and, ultimately, how educators will teach. Until then, this article serves as guide to assist educators with using Web 2.0 to support educational objectives and assess learners’ metacognitive activity.

References


