

Current Issues in Emerging eLearning

Volume 2

Issue 1 *MOOC Theoretical Perspectives and Pedagogical Applications*

Article 6

January 2015

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Paul Bond

University of Pittsburgh, paulbond@pitt.edu

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Recommended Citation

Bond, Paul (2015) "Information Literacy in MOOCs," *Current Issues in Emerging eLearning*: Vol. 2 : Iss. 1 , Article 6.
Available at: <https://scholarworks.umb.edu/ciee/vol2/iss1/6>

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INFORMATION LITERACY IN MOOCs

Paul Bond¹ University of Pittsburgh-Johnstown

INTRODUCTION

This article examines information literacy in the context of MOOCs. The article looks at a number of definitions of information literacy and their accompanying standards. The concept of metaliteracy as an umbrella for a number of literacies is also discussed. The purpose of this is to establish a broad understanding of information literacy in order to show the many ways it connects to MOOCs.

MOOCs are examined briefly. The focus here is to distinguish the different types of MOOCs and the different learner activities that go on within them. This study of MOOCs is based on relevant literature and direct observations from the experience of participating in MOOCs over the past few years.

MOOCs have been categorized as xMOOCs and cMOOCs. xMOOCs exist in a wide variety, and encompass ranges of learner activities, requiring varying levels of information skills. As they are all online, they all require some level of digital and computer literacy. cMOOCs are more participatory in nature, and have fairly well defined principles and learner activities. The learner activities of aggregating, remixing, repurposing, and feeding forward are mapped to Association of College and Research Libraries (ACRL) information literacy standards and performance indicators.

The importance of this for MOOCs is two-fold. One, as librarian organizations have been preaching for so long, information literacy skills must be taught, developed, and continually reinforced at every educational level as a life skill. Two, MOOC developers and facilitators should be ready to find ways to support and encourage learner participation, and to recognize the significance of the learning skills at work within the MOOC environment.

This also has importance within the broader realm of education and education policy, as it highlights the level of skills for independent, self-directed learning. Demographic studies indicate that most MOOC participants have bachelor degrees or higher (Balch, 2013; Belanger & Thornton, 2013; Breslow et al., 2013). This reinforces the idea that a high level of information skills, as might have been developed through prior educational attainment, is necessary for successful participation in a MOOC.

INFORMATION LITERACY

The ACRL in the United States defined information literacy as the “set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (2000). The ACRL defines five standards for information literacy, each with several performance indicators and outcomes. The standards are:

1. The information literate student determines the nature and extent of the information needed.
2. The information literate student accesses needed information effectively and efficiently.
3. The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.
4. The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.
5. The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally. (ACRL, 2000)

The Society of College, National and University Libraries (SCONUL) Working Group in the United Kingdom presented a somewhat different vision in their publication, *The Seven Pillars of Information Literacy: Core Model* (2011). They defined information literate individuals as showing “an awareness of how they gather, use, manage, synthesise and create information and data in an ethical manner and [having] the information skills to do so effectively” (p. 3). The SCONUL model includes seven standards, called “pillars,” and identifies several abilities and understandings for each one. Their standards are:

1. Able to identify a personal need for information
2. Can assess current knowledge and identify gaps
3. Can construct strategies for locating information and data
4. Can locate and access the information and data they need
5. Can review the research process and compare and evaluate information and data
6. Can organise information professionally and ethically
7. Can apply the knowledge gained: presenting the results of their research, synthesising new and old information and data to create new knowledge

and disseminating it in a variety of ways (SCONUL Working Group on Information Literacy, 2011)

The SCONUL model uses some different terminology from the ACRL standards but covers the same general concepts. In particular, it is more explicit in breaking down the idea of using information into organizing, synthesizing, creating and presenting information. It also presents the model as nonlinear, using a circle metaphor, and multidimensional, in that individuals can develop from novice to expert in the different skill areas.

The ACRL Standards have come under criticism. Kuhlthau (2013) said they did not accurately reflect the processes people go through in learning. She sees the ACRL standards as embracing a mechanistic and linear view of the information searching process, rather than recognizing the uncertainty and complexity of it. If information literacy is truly to enable “students’ self-directed learning” (p.96), then the affective component of the process should be addressed as well. Fister (2014) wrote that the standards were overly oriented towards undergraduate research papers and failed to address the creative and social aspects of information literacy.

The ACRL is revising its standards (S. Bell, 2013) as of this writing in early 2014 to incorporate the concept of metaliteracy, which considers information literacy as a blanket term covering a number of other literacies, such as visual literacy, digital/computer literacy, and media literacy (Jacobson & Mackey, 2013). This is in line with SCONUL, which includes “digital, visual and media literacies, academic literacy, information handling, information skills, data curation and data management” (SCONUL Working Group on Information Literacy, 2011, p. 3) as subsets of information literacy. The ACRL’s recommendation for a revised definition of information literacy is:

Information literacy combines a repertoire of abilities, practices, and dispositions focused on expanding one’s understanding of the information ecosystem, with the proficiencies of finding, using and analyzing information, scholarship, and data to answer questions, develop new ones, and create new knowledge, through ethical participation in communities of learning and scholarship. (ACRL Information Literacy Competency Standards for Higher Education Task Force, 2014, p. 4)

These standards and definitions are important because information literacy is considered to be the key to lifelong learning (ACRL, 2000; Coonan, 2011; Horton, 2008), and an integral part of the learning process (Middle States Commission on Higher Education, 2003). To engage in self-directed learning, one needs to know how to ask good questions, how to find and evaluate information

in pursuit of answers, and how to synthesize and communicate those answers. These activities are matched by the various standards for information literacy.

Learning takes many forms. Beyond the formal education system, there are modes such as continuing education and professional development, on-the-job training, and pursuit of personal interests. A relatively recent development in education is the Massive Open Online Course, or MOOC. MOOCs will be discussed in the section that follows.

MOOCs

With the amount of media hype MOOCs have garnered over the past two years, it is expected that most readers will have some knowledge of Massive Open Online Courses. They are learning events that take place on the Web, which can accommodate large numbers of people, from hundreds of participants to over a hundred thousand.

MOOCs have been broadly categorized into cMOOCs and xMOOCs (Rodriguez, 2012; Siemens, 2012), although in the author's experience they exist more in a spectrum than two distinct camps. xMOOCs are the type that has had the most media attention. MOOCs in the United States are primarily produced by the non-profit consortium edX, which lends the "x" to the term, and the for-profit startups Coursera and Udacity. Various other organizations around the globe, such as FutureLearn, iversity, Open2Study and OpenLearning, are also developing MOOCs, although this author does not have direct experience with their platforms. The U.S. xMOOCs typically feature recorded video lectures and machine-graded assessments, housed in a learning management system (LMS). Student interaction may occur in threaded discussion forums, and there may be peer graded assignments.

Learning activities in xMOOCs are mainly consumptive. Content is prescribed by the developers, and participant mastery or understanding of the content is measured through tests. Traditional information literacy skills, like finding, evaluating, synthesizing and presenting information are typically exercised only minimally. Computer literacy and digital literacy skills are exercised in negotiating course interfaces in the online environment. Sometimes participants set up Facebook groups or interact through Twitter, outside of the MOOC environment. Understood through the broader lens of metaliteracy, there are information literacy skills at work in xMOOCs. These computer and digital literacies are baseline skills necessary for participation, or even registration, in xMOOCs. Given that xMOOCs tend to focus on the transfer rather than the production of knowledge, however, information literacy as strictly defined by the ACRL standards plays less of a role than in cMOOCs.

Anderson and Dron (2011) categorized three generations of pedagogy for online learning. They are cognitive-behaviorism, social-constructivism and connectivism. These categories are useful for understanding the different types of MOOCs. Cognitive-behaviorist pedagogy tends to be dominant in xMOOCs. The cMOOCs are named after connectivism, the emergent learning theory that underpins their philosophy. They are typically decentralized and emphasize the production of content over consumption. Participants are encouraged to pursue their own goals and forge their own learning paths, so traditional assessments are rare. The next section will discuss connectivism in detail.

CONNECTIVISM

Connectivism was the topic of the first course to be called a MOOC (Siemens, 2008), and formed the theoretical basis for the early MOOCs. Connectivism is a theory of learning developed largely by George Siemens and Stephen Downes. It was developed in response to deficiencies they detected in other learning theories, such as constructivism, cognitivism and behaviorism. Such theories did not sufficiently account for the impact of the Internet on our understanding of the nature of knowledge and learning (F. Bell, 2011). As an emerging theory, connectivism has had some criticism (Kop & Hill, 2008), but that discussion is outside the scope of this article.

While Downes offers four succinct connectivist principles for learning, namely autonomy, connectedness, diversity and openness (Tschofen & Mackness, 2012) Siemens (2004) gives a more detailed picture:

Principles of connectivism:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known.
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may

be wrong tomorrow due to alterations in the information climate affecting the decision. (Siemens, 2004)

Bell (2011) points out three issues with other learning theories: “their intrapersonal view of learning; their failure to address the learning that is located within technology and organizations; and their lack of contribution to the value judgments that need to be made in knowledge-rich environments” (p. 102). The other theories, in Bell’s view, did not sufficiently account for self-directed, independent lifelong learning. Downes considered skills and aptitude for self-directed, independent lifelong learning to be something of a prerequisite for participating in a MOOC: “MOOCs expect that their participants will be motivated and will have learned how to learn” (2012b). Hogue (2014) likewise posits that there is an “expected digital literacy level” of participants.

Hill (2013b) discerned four archetypes of MOOC participants, which he labeled lurkers, drop-ins, passive participants and active participants. Lurkers observe and might sample a little content. Drop-ins participate at some level on a temporary basis, without intending or attempting to complete a course. Passive participants consume content without contributing. Active participants consume content, engage in assessments and provide peer feedback, and participate in discussions in forums in and outside of course. Hill points out that individuals do not necessarily stick with one distinct role. He also notes that some participants, in some cases the majority of participants, are there for the MOOC experience rather than the content of the course.

In practice, cMOOCs follow a path of guided or communal inquiry, and may be seen as more like communities of practice than courses. As Downes put it:

It’s about actually empowering people to develop and create their own learning, their own education. So not only do they not depend on us for learning, but also, their learning is not subject to our value-judgements and prejudices. ... It’s about reducing and eventually eliminating the learned dependence on the expert and the elite - not as a celebration of anti-intellectualism, but as a result of widespread and equitable access to expertise. (2012a)

Participation in these communities occurs through four general activities: aggregating, remixing, repurposing, and feeding forward. Siemens, Downes and Cormier (2011), in introducing one of their MOOCs, explained these activities:

Aggregate means to “pick and choose” among content. In order to have something for everyone, and in order to accommodate learners from a variety of backgrounds, with different levels of experience and expertise,

some courses include more content than one person could reasonably be expected to interact with and digest within the course schedule's time frame. Aggregation then is an evaluative process, wherein the learner considers his or her own knowledge and knowledge gaps, engaging in introspective self-evaluation, and examines a variety of content to determine what is best suited to the learner's particular situation. (Siemens et al., 2011)

Remix is explained as keeping track of the aggregated content, either locally in a document or, preferably, online in a blog or some other social media service. This is a way of organizing and curating information.

Repurpose is the act of building upon the content - drawing connections between elements, making connections to other content outside the course, adding personal thoughts and understandings. This is a way of synthesizing and creating information.

Feed forward is publicly sharing individual work. This can be done through blogs, video, images or other online media.

Dunaway (2011) also explored the relationship between connectivism, information literacy and lifelong learning, noting in particular the relationship between active learning, commonly advocated in the literature on information literacy, and connectivist learning activities. McBride (2012) sought to take this exploration a step further by putting connectivist theory into practice in information literacy instruction. The next section builds on this work by developing a visual representation of the connections.

MAPPING THE STANDARDS

The learning activities in cMOOCs - aggregate, remix, repurpose, feed forward - at a glance appear closely aligned with the ACRL information literacy standards. To explore this further, the five ACRL standards and the performance indicators for each were examined and color-coded according to the applicable cMOOC learning activity. Some connections between the learning activities and performance indicators were stronger than others. The color intensity was adjusted to visually represent the correlation.

cMOOC Learning Activities Mapped to ACRL Information Literacy Standards

	Aggregate	Remix	Repurpose	Feed forward	
	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5
<p>The information literate student determines the nature and extent of the information needed.</p>	<p>The information literate student accesses needed information effectively and efficiently.</p>	<p>The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.</p>	<p>The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.</p>	<p>The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.</p>	
<p>The information literate student identifies a variety of types and formats of potential sources for information.</p>	<p>The information literate student selects the most appropriate investigative methods or information retrieval systems for accessing the needed information.</p>	<p>The information literate student summarizes the main ideas to be extracted from the information gathered.</p>	<p>The information literate student applies new and prior information to the planning and creation of a particular product or performance.</p>	<p>The information literate student acknowledges the use of information sources in communicating the product or performance.</p>	
<p>The information literate student reevaluates the nature and extent of the information need.</p>	<p>The information literate student retrieves information online or in person using a variety of methods.</p>	<p>The information literate student compares new knowledge with prior knowledge to determine the value added, contradictions, or other unique characteristics of the information.</p>	<p>The information literate student revises the development process for the product or performance.</p>	<p>The information literate student understands many of the ethical, legal and socio-economic issues surrounding information and information technology.</p>	
<p>The information literate student considers the costs and benefits of acquiring the needed information.</p>	<p>The information literate student extracts, records, and manages the information and its sources.</p>	<p>The information literate student determines whether the new knowledge has an impact on the individual's value system and takes steps to reconcile differences.</p>	<p>The information literate student communicates the product or performance effectively to others.</p>	<p>The information literate student follows laws, regulations, institutional policies, and etiquette related to the access and use of information resources.</p>	
<p>The information literate student defines and articulates the need for information.</p>	<p>The information literate student constructs and implements effectively -designed search strategies.</p>	<p>The information literate student synthesizes main ideas to construct new concepts.</p>	<p>The information literate student validates understanding and interpretation of the information through discourse with other individuals, subject-area experts, and/or practitioners.</p>	<p>The information literate student follows laws, regulations, institutional policies, and etiquette related to the access and use of information resources.</p>	
<p>The information literate student refines the search strategy if necessary.</p>	<p>The information literate student refines the search strategy if necessary.</p>	<p>The information literate student validates understanding and interpretation of the information through discourse with other individuals, subject-area experts, and/or practitioners.</p>	<p>The information literate student articulates and applies initial criteria for evaluating both the information and its sources.</p>	<p>The information literate student determines whether the initial query should be revised.</p>	

Figure 1

The ACRL standards were compared to the definitions and descriptions of the learning activities aggregate, remix, repurpose and feed forward listed in the Change11 MOOC (Siemens et al., 2011). Aggregate relates to ACRL standards 1 and 2, which deal with determining information needs and accessing information. In picking and choosing among content, participants consider, whether consciously or not, their own interests, preferences and knowledge gaps, and decide what content and which formats are most appropriate for their needs. Remix relates to standards 2 and 3 in the aspects of selecting, tracking, organizing and summarizing information. Repurpose aligns standards 3 and 4 as they deal with using information and creating new information. Feed forward connects to standards 4 and 5 as they deal with communicating information. These activities can also be cross-mapped to the SCONUL standards using the information literacy standards map developed by Secker and Coonan (2011).

Because cMOOC participants are expected to choose among material supplied by facilitators or generated by other participants, indicators relating to evaluating sources were considered strongly correlated, while those related to the search process were less strongly correlated. Some of the indicators concerning economic, legal, and social issues were also less strongly correlated. While the economic, legal, and social issues of information use are present in MOOCs, the courses typically use open access or creative commons licensed materials, so the issues concern the facilitators more than the participants.

The purpose of this exercise is to draw clear connections between information literacy and connectivist MOOCs, in order to make a case that information literacy skills deserve the attention of the MOOC community. While information literacy is a significant area of concern among librarians, it is largely ignored elsewhere in academia (Badke, 2010). Mapping the relationship between the learning activities and the standards provides a tool to help raise the visibility of information literacy.

MOOC ACTIVITIES

This section will look at specific MOOCs and their learning activities as they relate to information literacy. This is to illustrate some of the connections in more detail.

INTRODUCTION TO SONGWRITING

The Introduction to Songwriting course, offered by Berklee College of Music through Coursera, aligned with most published accounts of typical xMOOCs. The course content was delivered primarily through prerecorded video lectures, some of which included inline quizzes. The inline quizzes in this course were multiple

choice questions typically asking the viewer to recall something the lecturer had just said. These quizzes assessed attention more than comprehension. Comprehension was assessed through learning management system based multiple-choice quizzes, which were auto-graded. Learners were asked to apply knowledge in songwriting exercises, which were evaluated by other students in a blind peer review process. Learners could interact with each other in a discussion forum.

Basic digital and computer literacy skills were necessary to find and register for the course, and to work with various elements within the course. Course resources included recorded music loops, which could be downloaded as .zip files, tutorials on audio recording, a list of suggested readings with links to Amazon for purchase, and a list of songs referenced in the lectures. To get the most out of the course, one would need skills to download, install and learn audio recording software, to work with the .zip files and to upload and share recordings. Some students located songs from the list on Youtube and shared lists of links with the rest of the participants. Some students formed Facebook groups for discussion and sharing information resources. Information resources that the students brought to the course included music theory resources, like chord charts, and links to further help with lyric writing and music composition. While there was no traditional academic research involved, the information literacy skills at work here were finding and accessing information, evaluating information and communicating information. Discussions offered opportunities for synthesizing information. Within the learning management system discussion forum, threads could be tagged, which would be an exercise in organizing information, but this functionality was almost never used during the observed iteration of the course.

INTRODUCTION TO INFOGRAPHICS AND DATA VISUALIZATION

The Introduction to Infographics and Data Visualization MOOC, offered by the Knight Center for Journalism in the Americas at the University of Texas at Austin, was not connected with any of the major MOOC providers (Coursera, Udacity, and EdX), but followed a similar format. Content was delivered through a combination of readings and recorded lectures, understanding was assessed through auto-graded quizzes and peer reviewed projects, and learner interaction was facilitated through a discussion board. The course also used a Facebook group for interaction and resource sharing. This group included the course instructor, and remained quite active after the course concluded. Subsequent iterations of the course used the same group.

Basic digital and computer literacy skills were needed to join and participate in the course, just as in the Berklee/Coursera course. Course resources

included links and tutorials for relevant software packages for infographics and data visualization. These software tools included both proprietary and free, open-source packages. Such tools were not required, as participants were welcome to draw graphics by hand and share scans or digital photographs of their work.

Given the course topic, there was a higher level of information literacy skill at play. Lectures, discussions and assignments involved discussing and evaluating information products and communication techniques. Small group forums were set up so groups of participants could collaboratively critique and evaluate various infographics according to criteria from the lectures and readings. Participants were asked to design their own infographics based on supplied data. The Facebook group frequently featured participant-contributed readings and graphics for additional discussion. The information literacy skills at work in his course included all the same skills as the Songwriting course, with more emphasis on evaluation and synthesis. Production and presentation were also integral elements. As these were all core to the topic of the course, participants had the opportunity to develop more advanced information skills and visual information skills, as well as exercise the skills they brought to the course.

UNIVERSITY OF MARY WASHINGTON DIGITAL STORYTELLING DS106

Digital Storytelling DS106 is a for-credit course available to the students at the University of Mary Washington in Fredericksburg, Virginia. It has been offered both in classroom and online forms. The instructors have chosen to run the course open and online so anyone can participate and contribute, although only tuition-paying students receive grades and credits. Students taking the course for credit are required to engage in a variety of activities. These activities are optional for open online participants.

The main course site, ds106.us, is a WordPress installation which pulls in blogs of all the course participants through RSS syndication. Each student is required to get a web domain and set up a blog. The students then experiment with their blogs and personalize them. Throughout the course the students write reflective blog posts about the course content and activities.

Some course content is delivered through lectures, readings and videos. Most of the course content is generated by the participants. Participants are offered a variety of creative challenges and assignments to produce image, audio and videos files. They are also encouraged (or required, in the case of for-credit students) to create course assignments and tutorials to help other participants complete assignments. Participants are regularly urged to comment on each other's work.

This course develops multiple literacies through practice and reflection. Since much of the course content is visual, participants engage in analyzing, producing and evaluating visual information. Audio assignments are also a prominent feature of the course, so participants likewise engage in analyzing, producing and evaluating aural information. Since all of the activity takes place on the web, and all of the content is produced through digital tools, computer and digital literacy skills are developed.

The course also highlights social and ethical aspects of information. Many of the activities involve remixing and transforming existing content, so issues of copyright and fair use are brought into discussion.

MOBIMOOC: A COURSE ON MOBILE LEARNING

MobiMOOC was an open online course on mobile learning. It was offered in two iterations, in 2011 and in 2012. It was organized by Inge de Waard and conducted with various free online tools, such as Google Groups and Wikispaces. It did not have any institutional support.

Course content included readings and online lectures, which were presented live and archived for asynchronous viewing. Content was also contributed by the participants, primarily through blogs in which they analyzed and reflected upon other content. As a typical cMOOC, the aggregate, remix, repurpose, feed forward activities were a significant feature, enabling collaborative peer learning. A number of participants brought into the course outside readings that were relevant to the topic of mobile learning. These were collected into a group Zotero library (<https://www.zotero.org/groups/mobimooc/items>). Other course outputs included working projects and a number of published research papers. These were not course requirements, but rather voluntary undertakings by various participants. The 2012 iteration of the course included a design competition for final projects.

This course exercised the same basic digital and computer literacies as the others, as well as some of the more advanced participatory literacies practiced in DS106. The bibliography was an exercise in information organization, and the course also led to discussions of subscriber-restricted versus open-access resources, and information ethics regarding copyright and fair use in the international arena.

MOOC DEMOGRAPHICS

There have been a number of studies of the demographics of MOOC participants. Some details are highlighted here:

- A graduate-level course on Computational Investing reported that 92.6% of course completers had college degrees and 88.9% of those who didn't complete had college degrees (Balch, 2013).
- In a course on Internet History, Technology and Security, 73% of the students had a degree (Hill, 2013a).
- Duke University reported that 72% of the students in their Bioelectricity course had a bachelor's degree or higher (Belanger & Thornton, 2013).
- The University of Edinburgh reported that 70.3% of the participants in six courses had completed undergraduate or postgraduate university (MOOCs@Edinburgh Group, 2013).
- Coursera reported that 75% of their students had at least a bachelor's degree (Hill, 2013a).
- A course on Circuits and Electronics offered through edX reported that 65% of the students had a bachelor's degree or higher (Breslow et al., 2013).
- In two courses on Sustainability offered through Coursera, 73% of students had at least a bachelor's degree (Tomkin & Charlevoix, 2014).

These studies suggest that the audience for MOOCs is primarily made up of experienced learners. Indeed, Downes (2012b) has stated that MOOCs were originally intended for this audience. Studies of MOOC persistence and completion rates, typically less than 10% (Jordan, 2013; Kolowich, 2013; Marcus, 2014), also suggest that the MOOC environment is not for everyone. A study by The Open University in the UK likewise indicates that MOOCs work well for advanced learners but not so well for those who need support (Sharples et al., 2013). Independent self-directed learning requires a certain amount of self-motivation and self-discipline in any case, but in the open online environment skills are necessary as well as aptitudes.

In some cases, such as the graduate-level course, it might be expected that the audience is at an advanced level. Zazani (2013) found a high percentage of respondents to her MOOC survey were affiliated with higher education, although that may be due to the course topic, e-learning and digital cultures. In a MOOC on information literacy set up by librarians from the Association of Independent Colleges of Art and Design, 95% of the registrants were other librarians and faculty (Maberry, 2013, October 25). This is undoubtedly an example of individuals joining a MOOC for the experience rather than the content, and it may say something about the level of student interest in information literacy as a subject.

INFORMATION LITERACY AND MOOCs

While information literacy may not be a popular course of study, it does comprise an important set of skills for participation in MOOCs. Different MOOCs require different sets and levels of skill, but they all require some basic digital and computer literacies. It appears important to have a more advanced level of information literacy to participate fully and contribute to some MOOCs. It is also reasonable to expect that engaging in a MOOC should help develop information skills through exercise and application.

Stewart (2013) pointed out that MOOCs of any type can help develop digital literacy skills, depending on the types of activities offered to participants. This observation could be expanded to the full spectrum of information literacy skills put into practice within MOOCs. The Joint Information Systems Committee (JISC) report on *Learning Literacies for the Digital Age* similarly recommends developing information literacy skills through participatory online learning environments (Beetham, McGill, & Littlejohn, 2009) like those found in MOOCs. If attention is not given to developing these skills, then the MOOC environment runs the risk of becoming more exclusionary (de Waard et al., 2014).

CONCLUSION

This paper has delineated connections between information literacy and MOOCs. Information literacy is an integral part of learning, and a key to lifelong learning. The models of information literacy are being adapted to evolving learning environments, such as those enabled by the web. New learning environments like MOOCs require a baseline level of information literacy. MOOCs following a connectivist pedagogy require a more advanced level of information literacy if participants are to take full advantage of the courses. These factors indicate that these skills are becoming increasingly significant, so it is now more vital than ever that they are developed throughout a person's educational career.

MOOC developers owe it to MOOC participants to give careful consideration to the key role information literacy plays in successful MOOC learning. As more of the courses move towards adopting more of a connectivist pedagogy, incorporating more participatory activities, they will be asking more of the participants. Developers should be prepared to support learners in information literacy development if they want to increase participation and persistence.

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ⁱ **Paul Bond** is a reference librarian and library instruction coordinator at the University of Pittsburgh's Johnstown campus. Befitting that role, he is an advocate and practitioner of information literacy and lifelong learning. He has been involved in numerous MOOCs over the past five years as a participant and observer. He has also co-taught some less than massive, sort of open, partly online courses on topics like the internet, digital storytelling, and true crime. Paul earned his MLS from SUNY at Buffalo in 2008 and has worked in a variety of school, academic, and public library environments. His professional memberships currently include the American Library Association and the Association of College and Research Libraries. His other interests include open education, lifelong learning and instructional technologies. Email: paulbond@pitt.edu