

# Share and Share Alike: Integrating Internet Resource Sharing Into Learning

Full Paper

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## Abstract

Despite instructors' concerns, students use "non-scholarly" Internet information resources to address their knowledge gaps or supplement their learning. In this research, students were encouraged to use such Internet resources to complete an individual course assignment and then share those resources to create a group submission. This allowed an investigation of perceived learning and development of social capital measured through quality and quantity. Assignments were introduced into eight courses over three semesters, providing a sample size of 210 undergraduate and graduate students. Two systems, one a social curation site and one the university's LMS, were evaluated as suitable platforms for such learning activities. Findings suggest that these learning assignments resulted in positive perceptions of learning as well as positive perceptions of the quality and quantity of social capital shared. Student engagement as reflected by the number of resources stored differed by system, suggesting increased student engagement in the social curation system.

## Keywords

Knowledge sharing, social capital, learning, technology-supported learning, social media.

## Introduction

The Internet abounds with information, and research has shown that Millennial students turn to Google as their first resource when confronted with some information need (Connaway et al. 2008). This use of Internet resources for learning is largely ignored in research and teaching due to its informal nature and concerns about the varying quality of the content students may find and use. To address this knowledge gap, this paper reports the results of research exploring the learning outcomes of assignments specifically instructing students to conduct research individually using Internet resources they feel are reliable but not necessarily scholarly (that is, published in an academic or research journal), and to subsequently share those resources with group members to collaboratively build knowledge and arrive at a cohesive group response.

At the same time, an assignment requiring students to find, manage, and share Internet resources demands unique affordances not necessarily included in a university's learning management system. This research therefore investigates Pearltrees, a social digital curation service, as an alternative technology for such assignments. This research is therefore guided by two research questions:

*RQ1: Do assignments requiring students to use, manage, share, and consolidate Internet information resources lead to positive perceptions of learning outcomes and social capital at the individual and group level?*

*RQ2: Do these learning outcomes differ depending on whether the students use the university's LMS or a social digital curation site for storing and sharing resources during the assignment?*

The remainder of this paper is organized as follows. Related literature that informed this research and the derived hypotheses are discussed in the next section. After briefly reviewing results of the semi-structured interviews that preceded this study, the design of the quasi-experimental field study and student surveys that provided the data for this paper are discussed. This is followed by the results of statistical analysis and a discussion of the implications of the findings as well as limitations of the research and conclusions.

## Related Literature

In the wake of Web 2.0 (O'Reilly 2006), a culture of participation, sharing, and collaboration is pervading technology and society. This cultural shift is evident in higher education as well, where educators and researchers are exploring learning based on a socio-cognitive model of students as active participants in a globally connected world (Bandura 2006). Participation in learning can occur at the individual and the group level, as evidenced by what Sfard (1998) calls the knowledge participation metaphor that incorporates the learning theories of Constructivism (Piaget 1970) and Social Constructivism (Vygotsky 1978). Constructivism views learners as active participants in their learning, building knowledge based not only on information but also past experiences and judgments. Social Constructivism extends this view to learners as members of a community in which they collaboratively build knowledge based on shared understanding (Hiltz et al. 2000; Scardamalia & Bereiter 1999). By creating an assignment that requires individual construction of knowledge followed by collaborative knowledge building, this research encompasses both of these learning theories to determine whether the use of Internet knowledge resources can be an effective learning activity supporting both individual and social learning as measured through perceived learning (Benbunan-Fich & Arbaugh 2006) and the formation of social capital (Chang & Chuang 2011; Nahapiet & Ghoshal 1998). This suggests the following three hypotheses:

*H1: Learning activities requiring the use and sharing of Internet resources will result in positive perceptions of learning.*

*H2: Learning activities requiring the use and sharing of Internet resources will result in positive perceptions of the quality of social capital.*

*H3: Learning activities requiring the use and sharing of Internet resources will result in positive perceptions of the quantity of social capital.*

Researchers have explored the effects of social capital, specifically interactions within a community, on both the quality and quantity of knowledge created or shared within that community. Some researchers have found that interactions among community of practice members affected the quantity, but not the quality, of the knowledge shared (Chiu et al. 2006). Other researchers have reported that social interactions had a positive effect on the quality, but not the quantity, of knowledge sharing behavior (Chang & Chuang 2011). Both of these studies treated quality and quantity of shared knowledge as outcome variables. In this study, quality and quantity of shared knowledge serve as independent variables that are theorized to affect perceived learning, suggesting the following two hypotheses:

*H4: The quality of shared knowledge will have a positive influence on perceived learning.*

*H5: The quantity of shared knowledge will have a positive influence on perceived learning.*

Information and communication technologies designed specifically to support learning activities incorporating the use, management, and sharing of Internet resources are nonexistent. While personal learning environments (PLEs) may support the bookmarking and management of Internet resources, they do not provide rich communication tools for resource annotation or discussions (Hiebert 2006; Johnson et al. 2006). At the same time, collaborative knowledge building systems support learner interactions and sharing of annotations, but do not facilitate individual learning through private learning spaces (Scardamalia & Bereiter 1999; Stahl 1999). University learning management systems (LMSs) such as Moodle were originally developed to facilitate online/distance education but have since evolved to support activities for blended or hybrid learning. LMSs have excellent capabilities for rich online discussions but lack support for social interactions and the personal curation and sharing of resources. After exploring a number of Web 2.0 technologies that support most of these activities (including Pinterest, Storify and Scoop.It), the Pearltrees system was chosen as an alternative system for this research. Pearltrees is a social digital curation system that is closely aligned with the activities of using and managing Internet

resources for individual use and sharing Internet resources with group members or with other Pearltrees users. It has been explored in the education domain because of its potential to facilitate peer-to-peer learning (Purser et al. 2013). Pearltrees allows students to store resources, called pearls, with a single click while browsing through a browser plug-in, and students can rearrange these pearls into hierarchical organizations called pearl trees using a visual, drag and drop interface. Pearltrees provides the capability for students to comment on pearls and share notes within the system and it facilitates collaboration through the creation of teams. Students can be invited to join teams in order to collectively curate shared Internet resources.

Learning activities involving the use and sharing of Internet resources require many of the same tasks as organizational knowledge management, including codifying, curating, sharing, and indexing knowledge (Davenport & Prusak 2000). Both Moodle (a learning management system) and Pearltrees (a Web 2.0 digital curation system) support these types of knowledge management activities, suggesting that both systems should equally facilitate the individual curation of Internet resources and the subsequent sharing of those resources with others. However, Moodle (the university's learning management system) is already familiar to students, while Pearltrees would require students to learn a new system. The complexity of having to learn a new system (Thompson et al. 1991) suggests that students using Moodle may engage more with their assigned system. This suggests the following specific questions related to system differences:

*RQ2.1: Will there be any significant differences in perceived learning outcomes and social capital formation between the two systems?*

*RQ2.2: Will students using Moodle store more Internet resources than students using Pearltrees?*

*RQ2.3: What system affordances are most important for supporting this type of assignment?*

## Research Methodology

The design of the field study and student surveys on which this paper is based were informed by prior semi-structured interviews conducted with 54 university students to understand why they search for Internet resources and how they share them with others (if they do). Thematic analysis of the interviews suggested that students' Internet information foraging activities are either instructor-driven (based on assignments or class requirements) or student-driven (based on a student's own internal information needs). In the case of research papers, instructor-driven foraging activities focused on using and citing scholarly resources (works published in research journals). For less formal assignments such as adding value to asynchronous online discussions, students reported finding a wider variety of resource types, including blogs, white papers, and news publications. Students in courses in which the instructor required asynchronous online discussions that "added value" felt that they learned more by reading the postings of other students and being exposed to alternate viewpoints and understandings.

Student-driven information needs fell into three distinct categories: seeking resources to get more information about a complex concept covered in class, defining or understanding an unfamiliar term or concept mentioned by the instructor, and assisting in the application of newly acquired skills to solve problems. Some students chose not to share these types of resources with others, citing feelings of learned helplessness (Guzdial & Carroll 2002) or stating that the resources were for their own personal use and would not be of interest to their classmates. However, many students did share either the Internet resource itself or the knowledge gained from it. Some students stated they would teach others what they had learned from the resource, while other students stated that they would share links to the Internet resources with all their friends through social media including Facebook and Twitter. These responses suggested that students were already using Internet resources for their own learning needs; this research therefore explores what happens when students engage in course assignments requiring the use and sharing of Internet resources.

Because this research involves formal learning activities, the first step (after approval of the research by the university's Institutional Review Board) was to solicit instructors willing to integrate this type of assignment into their coursework. After several instructors had agreed to participate in this research, assignments were created that would require students to independently conduct research using Internet resources to complete an individual assignment. After the individual assignment was completed, students

were provided with group sharing areas in either Moodle or Pearltrees in which they could share their resources and discuss and complete their group assignment. (In Moodle, students shared resources in private group forums. In Pearltrees, the researcher created teams and then invited students to join.) Because the assignment was part of their coursework, students were required to complete the assignment but were invited to participate in the research surveys before and after the assignments were completed. The procedures, systems, and instruments were pilot tested in one course in the Fall of 2013. Slight modifications to the survey instruments and assignment instructions were made based on the findings from the pilot test prior to beginning the larger field study in the Spring of 2014.

In total, eight courses were included in this research. Seven of these courses were in the Information Systems discipline; the eighth was in the university's Science, Technology and Society program. The courses and number of participants per course are listed in Table 1, along with brief descriptions of the research assignments for each course.

<b>Participants and Assignment per Course</b>	
<b>Database Design Management and Application (SPR14)</b> Select one database-related topic not covered in class (e.g. graph databases, NoSQL/Nonrelational databases, database security), provide a summary of the topic and describe situations in which the technology could be effectively used.	22
<b>Database Design Management and Application (FALL14)</b> Research nonrelational databases (NoSQL) and MongoDB prior to their introduction in class, identifying their key elements and the environments in which nonrelational databases would be most applicable.	20
<b>Systems Analysis and Design (SPR14)</b> Explore two security breaches, comparing the IT and business strategies of both companies and contrasting their responses to the breaches.	25
<b>Advanced Systems Analysis and Design (FALL13)</b> Research the topic of object-oriented modeling and design patterns that had been introduced in class and explain why these concepts are important in software development.	25
<b>Information Systems Principles (SPR14)</b> Apply the four components of an information system to information system project failures described in the textbook and provide alternate solutions.	34
<b>Information Systems Principles (FALL14)</b> Apply the four types of organizational structures to an analysis of the FBI and similarly structured organizations.	50
<b>Information Systems Strategy (SPR14)</b> Apply Hofstede's cultural dimensions to an analysis of two international consulting companies, exploring the representation of the cultural norms of the country within each organization's structure.	21
<b>Women in Technological Culture (FALL14)</b> Select one topic relating to gender in light of the UN-sponsored HeForShe campaign and identify resources to help in creating a short video about the selected gender issue.	13

**Table 1. Course and Assignment Information**

For students who consented to participate in the research surveys, a link to an online survey (hosted on SurveyMonkey.com) was provided at the beginning of the research assignment. The link to the post-assignment survey was not made available until after students had submitted their group assignments.

The measurement scales included in this research were validated scales from prior research that were adapted for the purposes of this study. To evaluate the development of social capital, two measures were adopted from Chang and Chuang (2011): quantity of social capital and quality of social capital. Quantity of social capital was also measured as system use through a count of the number of resources learners stored in their assigned systems. Perceived learning was measured using the scale validated by Benbunan-Fich and Arbaugh (2005). All of the scales were based on a five-point, Likert-type scale with responses ranging from Strongly Disagree (1) to Strongly Agree (5) with a Neutral option (3).

Responses from the pre- and post-assignment surveys were first screened individually for unengaged responses and were subsequently merged by matching student identifiers. The final sample contained 210 complete survey responses. All data analysis was conducted using IBM SPSS Version 22.0.0.1.

## Results

The results of this research begin with a description of participant demographics. This is followed by discussions of the results addressing each of the two research questions and testing the hypotheses.

### *Participant Demographics*

Demographic information such as gender, educational level (undergraduate/graduate), degree program, and previous sharing experience were captured at the beginning of the pre-assignment survey. Results are summarized in Table 2.

<b>Demographic Data</b>		
<b>Gender</b>	147 Male (70%)	63 Female (30%)
<b>Assigned System</b>	115 Moodle (54.8%)	95 Pearltrees (45.2%)
<b>Educational Level</b>	74 Undergraduate (35.2%)	136 Graduate (64.8%)
<b>Previously Shared Internet Resources for Learning</b>	163 Yes (77.6%)	47 No (22.4%)
<b>Degree Program</b>		
<b>Information Systems</b>	76 (36.2%)	
<b>Computer Science</b>	5 (2.4%)	
<b>MBA</b>	16 (7.6%)	
<b>Other (Information Technology, Business Information Systems, Computer Engineering)</b>	113 (53.8%)	

**Table 2. Participant Demographics**

### *Perceived Learning and Social Capital*

Research question 1 asks, “Do assignments requiring students to use, manage, share, and consolidate Internet information resources lead to positive perceptions of learning outcomes and social capital formation at the individual and group level?” The answer is yes. Despite instructors’ fears that students would find unreliable or inaccurate information on the Internet, the univariate results of the perceived learning measures were very positive (as shown in Table 3), suggesting that students felt they had learned from assignments that allowed them to conduct research using public sources available on the Internet. The Cronbach’s alpha for the perceived learning scale was 0.89, suggesting that the scale is highly reliable.

<b>Perceived Learning</b>	<b>Mean</b>	<b>SD</b>	<b>t statistic (df = 209)</b>
PL1 – I developed a good understanding of the basic concepts during this assignment.	4.13	0.71	23.25***
PL2 – I was able to identify central issues about this topic.	4.02	0.69	21.57***
PL3 – The quality of this assignment compared favorably with other activities in this course.	3.73	0.83	12.84***
PL4 – I developed an improved ability to integrate facts through this assignment.	3.81	0.74	15.86***
PL5 – I learned to see relationships between ideas during this assignment.	3.81	0.75	15.72***
PL6 – This assignment improved my ability to communicate clearly.	3.71	0.86	11.83***
PL7 – This assignment served my needs well.	3.72	0.85	12.28***
PL8 – I am satisfied with this assignment.	3.87	0.82	15.35***
PL9 – I feel the assignment resulted in high quality interactions.	3.63	0.92	9.98***
PL_TOTAL	34.45	5.24	20.59***
Cronbach's alpha	0.89		
*** $p < 0.001$			

**Table 3. Results of One-Sample T-test for Perceived Learning**

The results shown in Table 3 suggest that, for the individual items measuring perceived learning, students reported the strongest positive perceptions with regard to developing a basic understanding of the concept covered in the assignment (PL1) and identifying the central issues of the topic (PL2). The lowest positive perception, while still slightly above neutral, was reported about the quality of interactions between students during the assignment (PL9). An exploration of the actual in-system interactions suggests that students tended not to use their assigned systems for group interactions, instead meeting face to face to discuss their group submission.

Table 4 shows the results of the one-sample t-test for the quality of social capital scale, which has a Cronbach's alpha of 0.82. Responses suggest that students felt positively about all aspects of the quality of the social capital shared during the assignment.

<b>Quality of Social Capital</b>	<b>Mean</b>	<b>SD</b>	<b>t statistic (df = 209)</b>
QLSC1 – The knowledge shared by members of my group was understandable.	3.97	0.76	18.44***
QLSC2 – The knowledge shared by members of my group was accurate.	3.86	0.71	17.47***

QLSC3 – The knowledge shared by members of my group was complete.	3.93	0.87	15.50***
QLSC4 – The knowledge shared by members of my group was reliable.	3.99	0.69	20.75***
QLSC_TOTAL	15.75	2.46	22.15***
Cronbach's alpha	0.82		
*** $p < 0.001$			

**Table 4. Results of One-Sample T-test for Quality of Social Capital**

Table 5 shows the results of the quantity of social capital scale which, while still acceptable, had the lowest Cronbach's alpha (0.72) of the three scales. While the one-sample t-test results for each item were above the neutral, the lowest perception was reported for the frequency of knowledge being shared or posted, suggesting that students were satisfied with the overall quantity of resources shared but they felt their team members did not share knowledge resources as frequently as desired.

Quantity of Social Capital	Mean	SD	t statistic (df = 209)
QNSC1 – New content and knowledge was shared or posted frequently by my group.	3.57	0.97	8.45***
QNSC2 – Group members could obtain abundant content and knowledge from the shared information.	3.94	0.84	16.27***
QNSC3 – Group members provided meaningful comments to the shared information.	3.85	0.84	14.64***
QNSC_TOTAL	11.36	2.13	16.05***
Cronbach's alpha	0.72		
*** $p < 0.001$			

**Table 5. Results of One-Sample T-test for Quantity of Social Capital**

Together, these results suggest that H1 (perceived learning), H2 (quality of social capital), and H3 (quantity of social capital) are supported, suggesting that learning activities prompting students to conduct individual research using Internet resources and to subsequently share those resources with group members to consolidate the information into a cohesive group response do result in positive perceptions of learning. At the same time, sharing Internet resources for learning creates positive perceptions of shared social capital in terms of both quality and quantity.

A Pearson's correlation was calculated to evaluate the relationships between quality of social capital and perceived learning ( $r = 0.70$ ,  $p < 0.01$ ) and quantity of social capital and perceived learning ( $r = 0.73$ ,  $p < 0.01$ ). Multiple regression analysis was subsequently conducted to examine the relationship between perceived learning and its two predictors: quality and quantity of social capital. The multiple regression model with both of these predictors produced an adjusted  $R^2 = 0.59$ ,  $F(2, 207) = 149.81$ ,  $p < 0.001$ , suggesting that quality and quantity of social capital explain 59% of the variance in perceived learning. These results, summarized in Table 6, suggest that hypotheses H4 and H5 are supported: both quality and quantity of social capital shared during this type of assignment lead to positive perceptions of learning.

Independent Variable	Pearson's r	B	$\beta$
Quality of Social Capital	0.70**	0.75	0.35***
Quantity of Social Capital	0.73**	1.16	0.47***
<b>R<sup>2</sup> = 0.59, F (2, 207) = 149.81, p &lt; 0.001</b>			
** p < 0.01, *** p < 0.001			

**Table 6. Results of One-Sample T-test for Quantity of Social Capital**

### **ICT System Differences**

Research question 2 asks, “Do learning outcomes differ depending on whether the students use the university’s LMS or a social digital curation site for storing and sharing resources during the assignment?” Although learning outcomes did not differ depending on the ICT system students used (RQ2.1), students’ use of the systems did differ, suggesting that student engagement was affected by the system to which they were assigned. Despite the fact that most students were unfamiliar with Pearltrees, students using this system stored significantly more resources than students who used Moodle for the individual assignment (RQ2.2).

System	Mean	SD
Moodle	2.92	3.86
Pearltrees	4.55	4.68
		<b>t = -2.76, p = 0.006 (df = 208)</b>

**Table 7. Differences in System Usage for Individual Assignment**

One explanation for this difference could be that the affordances of Pearltrees are more closely aligned with the activities of storing, managing, and sharing Internet resources (RQ2.3). For example, Pearltrees provides a visual interface that enables students to drag and drop resources into hierarchical organizations. Pearltrees also provides a browser plug-in that facilitates storing and organizing Internet resources while browsing.

Analysis of the qualitative survey data provided by students in response to open-ended questions about the two systems used in this research yielded interesting insights regarding what students liked most and least about each system, and thus what system affordances are most important. For example, students were generally satisfied with Moodle’s advanced discussion capabilities; they also noted the convenience of having all of the course content and activities in one system. However, students stated that Moodle’s sharing capabilities were “very basic.” In order to store Internet resources in Moodle, students had to copy the URLs of websites and paste them into discussion forums. For other students to then view these resources, they had to locate the necessary forum posting, copy the link from Moodle, and open the resource themselves.

Pearltrees, on the other hand, was reported to be lacking in discussion tools, but made it easy to share Internet resources with others. The fact that the resources stored in Pearltrees actually linked directly to the content of those resources was frequently cited as an important capability for this type of assignment. Finally, organizing resources in Pearltrees was simple through a visually appealing, drag and drop interface, while Moodle offered no capability to organize resources outside of pasting them into threaded discussions.

## **Discussion and Limitations**

This study explores students' perceptions of learning through activities requiring the use, management, sharing and consolidation of Internet information resources. Integrating Constructivist learning theories through the requirement for individual research and Social Constructivist learning theories through collaborative knowledge building, this research finds that students reported positive perceptions of the individual and social learning that result from these types of assignments. Additionally, this research incorporates Internet resource sharing and consolidation as a form of social learning, finding that students had positive perceptions of social learning as captured through the quality and quantity of shared social capital. Finally, this research moves beyond the traditional requirement of scholarly citations, finding that students report a positive learning outcome from research using Internet resources that the students themselves have evaluated and assessed.

Allowing students to use Internet resources for learning means that instructors can create assignments exploring current topics. For example, the instructor in one course was able to create an assignment shortly after the Facebook emotional contagion study (Kramer et al. 2014) had been heatedly debated in the public forum. This assignment asked students to evaluate the ethical concerns of the study long before any scholarly resources would have been available. Instead, students identified and shared a variety of resources that presented both sides of the ethical debate, allowing for a richer and more relevant learning experience.

Finally, this study evaluates the use of two different information and communication technologies for assignments requiring the use, management, and sharing of Internet resources for learning. Although Moodle is the university's learning management system and is therefore familiar to most students, students assigned to use Pearltrees actually stored more resources than students using Moodle. Students' comments were positive towards Moodle's discussion capabilities and its integration with other course materials; positive comments about Pearltrees focused on the ease of sharing and managing Internet resources. These comments suggest that systems designed to support these types of learning activities should provide rich communication tools, methods to share and organize live links to resources, and integration with browsers to facilitate storing while searching. While neither Pearltrees nor Moodle was particularly well-suited to all of the activities required for this type of assignment, the results suggest that students were, on the whole, equally able to accomplish the assignments and felt that they had learned, despite any system deficiencies.

This study has several limitations that affect its generalizability. First, the findings of this study are based on a limited number of courses, all offered at one university, most of which were in the Information Systems discipline. Future research should integrate these types of learning activities into courses in other disciplines at other universities. Additionally, all of the courses included in this research were traditional (face to face) courses. Future studies should extend this research to online courses to see whether the remote nature of the participants would affect the results. Finally, the assignments in this research required students to share Internet resources with group members, rather than letting students decide whether or not they wanted to share. Future research should explore assignments in which sharing is voluntary rather than forced, to assess the impact on learning and also understand students' motivations for sharing or not sharing.

## **Conclusion**

This research contributes to the existing literature by adding to the current understanding of how students learn, and how social capital develops, through learning activities requiring the use and sharing of Internet information resources. It identifies important benefits of allowing students to conduct research using Internet resources (e.g. the ability to research current topics as they unfold), while at the same time alleviating instructors' concerns about learning outcomes resulting from resources that have not been reviewed for publication in academic or research journals. In addition, this research contributes to the domain of learning systems by identifying key capabilities needed to better support students in completing assignments integrating individual and social learning using Internet resources.

## REFERENCES

- Bandura, A. 2006. "Toward a psychology of human agency," *Perspectives on Psychological Science* (1), pp. 164-180.
- Benbunan-Fich, R., and Arbaugh, J.B. 2006. "Separating the effects of knowledge construction and group collaboration in learning outcomes of web-based courses," *Information & Management* (43:6), pp. 778-793.
- Chang, H.H., and Chuang, S-S. 2011. "Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator," *Information & Management* (48), 9-18.
- Chiu, C-M. Hsu, M-H, & Wang, E.T.G. 2006. "Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories," *Decision Support Systems* (42), 1872-1888.
- Connaway, L.S., Radford, M.L., Dickey, T.J., De Angelis Williams, J., and Confer, P. 2008. "Sense-making and synchronicity: Information-seeking behaviors of Millennials and Baby Boomers," *Libri* (58:2), pp. 123-135.
- Davenport, T., & Prusak, L. 2000. *Working Knowledge: How Organizations Manage What They Know*, Boston, MA: Harvard Business School Press.
- Guzdial, M., and Carroll, K. 2002. "Exploring the lack of dialogue in computer-supported collaborative learning," in *Proceedings of Computer-Supported Collaborative Learning: Foundations for a CSCIL Community*, pp. 418-424.
- Hiebert, J. 2006. "Your goals are the future headspace," <http://headspacej.blogspot.com/>.
- Hiltz, S.R., Benbunan-Fich, R., Coppola, N., Rotter, N., and Turoff, M. 2000. "Measuring the importance of collaborative learning for the effectiveness of ALN: A multi-measure, multi-Method approach," *Journal of Asynchronous Learning Networks* (4:2), pp. 101-119.
- Johnson, M., Liber, O., Wilson, S., Sharples, P., Milligan, C., & Beauvoir, P. 2006. "Mapping the future: The personal learning environment reference model and emerging technology," in *Proceedings of ALT-C 2006 Research*.
- Kramer, A.D, Guillory, J.E., and Hancock, J.T. 2014. "Experimental evidence of massive-scale emotional contagion through social networks," in *Proceedings of the National Academy of Sciences* (111:24), pp. 8788-8790.
- Nahapiet, J., and Ghoshal, S. 1998. "Social capital, intellectual capital, and the organizational advantage," *The Academy of Management Review* (23:2), pp. 242-266.
- O'Reilly, T. 2005. "What is web 2.0? Design patterns and business models for the next generation of software," <http://oreilly.com/>.
- Piaget, J. 1970. "Piaget's theory," in *Carmichael's manual of child psychology* (3<sup>rd</sup> ed.). P.H. Mussen (ed.) Hoboken, NJ: Wiley & Sons.
- Purser, E.R., Towndrow, A., and Aranguiz, A. 2013. "Realising the potential of peer-to-peer learning: taming a MOOC with social media," *eLearning Papers* (33), pp. 1-5.
- Scardamalia, M., and Bereiter, C. 1999. "Knowledge-building organizations," *Development Health and the Wealth of Nations: Social, Biological, and Educational Dynamics*, pp. 274-289.
- Sfard, A. 1998. "On two metaphors of learning and the dangers of choosing just one," *Educational Research* (27:2), pp. 4-13.
- Stahl, G. 1999. "Reflections on WebGuide: Seven issues for the next generation of collaborative knowledge-building environments," in *Proceedings of Computer-Supported Collaborative Learning*, pp. 600-610.
- Thompson, R.L., & Higgins, C.A. 1991. "Personal computing: Toward a conceptual model of utilization," *MIS Quarterly* (15:1), 125-143.
- Vygotsky, L.S. 1978. *Mind in Society: The development of the higher psychological processes*. Harvard, MA: Harvard University Press.
- White, C.M., Plotnick, L., Kushma, J., Hiltz, S.R., and Turoff, M. 2009. "An online social network for emergency management," *International Journal of Emergency Management* (6:3/4), pp. 369-382.