

A Longitudinal Study to Determine if Wiki Work Builds Community among Agricultural Adult Education Students

Kathleen D. Kelsey, Professor

Hong Lin, Ph.D., Faculty Development Manager, Institute for Teaching and Learning Excellence
Oklahoma State University

Tanya C. Franke–Dvorak, Education Officer, Biosecurity Research Institute
Kansas State University

Wiki has been lauded as a tool that enhances collaborative writing in educational settings and moves learners toward a state of communal constructivism (Holmes, Tangney, FitzGibbon, Savage, & Mehan., 2001). Many pedagogical claims exist regarding the benefits of using wiki. However, these claims have rarely been challenged. This study used a three–year longitudinal cohort survey design (Creswell, 2008) to measure learners’ perception regarding the pedagogical claims of wiki to create an online textbook in a graduate agricultural adult education course. The overall survey mean was 2.37 on a four–point scale (2.0 = not sure, 3.0 = agree). Learners were positively but marginally impacted by the wiki writing experiences in terms of knowledge construction and enhanced critical thinking skills. Study results marginally support Holmes’ et al. theory that interactive communication technologies (ICT) create constructivist learning opportunities. Collaborative writing does not naturally emerge from wiki work. Rather, it must be coaxed and nurtured through reward and a self–directed learning approach.

Keywords: collaborative learning, wiki, collaborative writing, information and communication technology

Introduction

The proliferation of personal computers and Internet access has enhanced options for facilitating communication and information sharing, including Web 2.0 technologies, among learners. Wiki is among a growing list of Web 2.0 applications and has increased in popularity, especially in educational settings under the promise of enhanced learning in the realm of collaborative writing.

Wiki has the potential to build online communities for the purpose of producing knowledge and products. eXtension.org was launched in 2006 by Cooperative Extension to provide online access to land–grant university research–based information. eXtension.org is a

wiki developed by communities of practice (Harder & Lindner, 2008). The American Association of Agricultural Educators established a wiki in 2008 for members to co–write the AAAE manual for planning future conferences (<http://aaae.wikispaces.com/>).

Wiki has been incorporated as a teaching and learning tool for face–to–face as well as distance education applications at all educational levels (Schwartz, Clark, Cossarin, & Rudolph, 2003). Wiki writing fits the constructivist philosophy that knowledge is open to explanation, alteration, and reconstruction at any time by anyone. This research reports the results of a three–year longitudinal study that measured learners’ perceptions of learning outcomes when using wiki as a collaborative writing tool in an agricultural adult education graduate course.

Literature Review

The study was rooted in grand constructivist learning theory and information and communication technology (ICT) applications that enhance learning outcomes in higher education. The underlying assumption that ICT improves educational outcomes has been manifested in the Enhancing Education through the Technology Act of 2001 (Kotrlik & Redmann, 2009). It is widely held that the use of ICT improves learning by (a) creating learning communities, (b) allowing communities to construct knowledge through dialogue, (c) providing constructed knowledge that is useful to learners, (d) enhancing learners' critical thinking skills, and (e) capturing text-based dialogue for future reference (Alston & Warren English, 2007; Edwards, 2002; Sharma & Hannafin, 2007). Camp (2010) called for an intellectual commons for the agricultural education university community in his 2009 distinguished lecture using ITC to facilitate resource sharing among AAAE members. Furthermore, Alston and Warren English (2007) recommended web-based resources be incorporated into assignments with collaborative groups in agricultural education courses to foster "problem solving, increase technological literacy, and improve socialization skills" (p. 8).

The value of ICT in education shows mixed results in the literature. Hammond (2002) used an online forum to help reduce isolation for student teachers in the field but discovered the student teachers did not use the forum as expected. He concluded that "on-line discussion is peripheral to the process of learning to teach even for a group of experienced and confident ICT users" (p. 2). Similarly, Roberts, Murphy, and Edgar (2010) studied how ICT was used to facilitate learner-learner interactions. They found that agricultural education student teachers interacted with each other using ICT, including email and text messages and formed small networks to support professional development; however, they preferred face-to-face and telephone interactions over ICT. Conversely, McKibben, McDonald, Holmes, and Tangney (2001) reported the use of ICT significantly impacted learning outcomes; namely the development of a learning community by allowing students to communicate with their peers anytime,

anywhere in an information technology graduate course. Wang (2009) found participants engaged in social activities online and ICT facilitated constructivist learning. Alston and Warren English (2007) reported students in undergraduate agricultural education courses enjoyed components of course websites, such as multimedia course materials and class discussions, and found them useful and an "effective means of communication between faculty and students, and student to student" (p. 7).

The literature becomes sparse when addressing the educative value of using wiki in higher education. Harder and Lindner (2008) found that only eight percent (8%) of extension educators in Texas were using eXtension.org, in spite of the national director's goal to have 75% of all Extension employees using eXtension.org by 2007. Fuchs-Kittowski and Köhler (2005) developed a prototype for integrating communities of practice using wiki to support work processes but offered no data to support claims of effectiveness. Blank, Cassidy, Dalke, and Grobstein (2004) found that maintaining ownership of students' work prevented true collaboration among students using wiki. In her attempt to use a discussion board to create a virtual community among students in three countries, Edwards (2002) reported that "very little sharing (of professional practices for mutual gain) on either front took place at any critical level without intense tutor encouragement and prompting. Whenever tutors stood back...debates soon withered" (p. 5). While educators are adopting technology for use in the classroom, Kotrlik and Redmann (2009) reported many barriers continue to prevent teachers from adopting ICT fully, including wiki.

In summary, educators laud the use of wiki for supporting collaborative and inquiry-based learning (Engstrom & Jewett, 2005), improving student collaboration (Chu, 2008), improving critical thinking skills and facilitating life-long learning (Freeman, Holmes, & Tangney, 2001). However, little research has been conducted to validate the pedagogical promise of wiki (Edwards, 2002; Freeman et al., 2001; Hammond, 2002). In fact, the literature regarding the use of ICT, including wiki, in educational environments is based on "speculative and aspirational stances rather than

strong theoretical or empirical grounds” (Edwards, 2002, p. 1) and extrapolates from research concerning learning outcomes from computer-mediated communications (CMC). Theoretical assumptions are borrowed from constructivist philosophies, such as Bandura (1977) and Vygotsky (1978) but have not been thoroughly examined within the ICT context. This study adds to the literature regarding students’ perceptions of using wiki in terms of enhanced learning outcomes.

Theoretical Framework

Communal constructivism is defined as “an approach to learning in which students not only construct their own knowledge (constructivism) as a result of interaction with their environment (social constructivism) but are also actively engaged in the process of constructing knowledge for their learning community” (Holmes et al., 2001, p. 1). Techniques that enhance communal constructivism include project-based learning, peer-teaching, group work, and knowledge creation and management, including publishing information. Meehan, Holmes, and Tangney (2001) tested their theory of communal constructivism in a primary school and reported the results using first-person narratives from the voices of academics (the authors), primary school teachers (also post-graduate students), and primary school students to explain that teachers and students learn communally when taught from the communal constructivist epistemology. The authors concluded that teaching techniques framed in the communal constructivism theory such as peer tutoring, publishing student work on the Internet, various role assumptions by students as teachers, assessment via portfolios, and teacher training led to enhanced learning outcomes.

While Holmes et al. (2001) did not specify postulates for their theory, they made seven assertions that *if* teachers create a communal constructivist learning environment, *then* students will demonstrate enhanced learning outcomes. The assertions are:

1. “If the student learning processes and their work could be captured, then courses might instead build on knowledge rather than simply repeat it” (p. 4).

2. Asking students to leave their imprint on the course benefits their learning and provides teaching apprenticeships for the next generation.
3. “The communal constructivist approach requires that the course be dynamic and adaptive” (p. 4).
4. Students must “see themselves as producers and not just consumers of information” (p. 5) and “become publishers...of information through the use of ICTs” (p. 4).
5. Students must be “involved in the process of constructing knowledge and that construction is a communal affair” (p. 5).
6. Communal constructivism advocates learner empowerment by asking learners to take part in meaningful activities and allowing them to have a role in society by contributing knowledge, not only consuming it.
7. “Communal constructivism stresses that learners should be listened to and be important to others. They must be included and their work should be valued by others” (p. 6).

These seven assertions were codified into 119 survey questions to answer the research questions.

Purpose

The purpose of this study was to measure graduate students’ perceptions of learning outcomes when creating an online textbook using wiki in an agricultural adult education course. Specifically, did students perceive:

1. Their work was used by self and others for knowledge construction?
2. Building the wiki enhanced their learning outcomes, including critical thinking, and they left an imprint on the course?
3. The wiki assignment was dynamic and adaptive?
4. They were producers of knowledge and valued publishing their work in the wiki?
5. They were involved in constructing knowledge collaboratively within a community?
6. They were becoming responsible life-long learners by contributing knowledge to society?
7. Their work was valued by others?

Methodology

The study used a longitudinal cohort survey design (Creswell, 2008). A researcher developed a 119-item instrument to measure students' perceptions. The 119 items were clustered into 21 constructs to reflect Holmes' et al. (2001) seven postulates using five-point Likert-scaled questions (4 = strongly agree, 3 = agree, 2 = not sure, 1 = disagree, 0 = strongly disagree). The 21 constructs are detailed in Table 1 along with the seven research questions they were designed to answer.

To ensure face, content, and construct validity, the instrument was reviewed by a panel of experts in educational theory and the use of ICT. The instrument was piloted with a group of 17 graduate students from another university after completing a similar wiki article assignment. The reliability coefficient for the pilot study was 0.96. Internal reliability estimates were calculated after the survey was administered and the survey was found to be reliable (Cronbach's alpha = 0.94). Due to the small sample size, other tests of reliability were inappropriate. Furthermore, there was no attempt to generalize the results of the study to other populations.

The population included students from three cohorts enrolled in a graduate course on agricultural adult education taught at Oklahoma State University (2006–2008). Thirty-two ($n=32$) of 37 students completed the survey at the conclusion of the semester. A census was sought; however, five students declined to participate, resulting in an 86% response rate (the 2006 cohort had five students, all completed the survey; the 2007 cohort had 17 students, 16 completed the survey; the 2008 cohort had 15 students, 11 completed the survey). All students were advised of their rights as human subjects. Willing participants signed a consent form.

The instructor built the wiki shell using Mediawiki® software and posted it online, purposefully public and accessible, to examine the assumption that public presentation of students' work influences motivation to produce high quality and accurate products. The instructor populated the wiki with 15 major chapter headings and 34 subchapter headings but added no content before the first course began.

Students were required to create three original articles in wiki and were given a

detailed rubric for completing the assignment. Each article was worth 10% of the course grade; thus, the wiki articles constituted 30% of the total course grade. Heavy weighting of the assignment stressed the value of a collaborative and constructivist effort.

Students could create an article under the instructor-defined headings or create a new heading as long as the article was related to agricultural adult education. Each student was required to write one article as a solo effort and one article within a team. Students could choose to work solo or in a team to create the third article. In addition, students were asked to keep a reflective diary regarding their learning process as a result of creating their wiki articles. Finally, students were asked to present their articles in class to address Holmes et al. (2001) assertion that "learners should be listened to and be important to others" (p. 6).

The survey data were descriptively analyzed using SPSS© 17.0 software. Columns were checked for missing numbers and data were analyzed by one researcher and reviewed by a statistics expert who was independent of the study.

Findings

The results of the study indicated students were positively, however, marginally impacted by creating and presenting content in wiki (overall mean = 2.37 where 2.0 = not sure and 3.0=agree). *T*-scores between class groups (0.05 scale) showed there were statistically significant differences between class groups, yet class groups 2007 and 2008 were most alike (critical t 2.05 < calculated t 2.37). The differences between the 2006 and 2008 (critical t 2.58 < calculated t 4.88) and the 2006 and 2007 class (critical t 1.46 < calculated t 3.11) group may be attributed to the differences in class sizes. Table 1 reports the mean, median, and standard deviation for each of the 21 constructs. The constructs are grouped according to the research question addressed.

Research Question One

Research question one was addressed by two constructs (Table 1). The mean for both constructs was 2.16 (median = 2.5, SD = .50), indicating students were *not sure* if their work was used by others for knowledge construction.

Unless assigned, students rarely used other students' articles for their assignments or edited other students' articles in wiki.

Research Question Two

Research question two was addressed by five constructs (Table 1). The mean for all five constructs was 2.7 (median = 3, $SD = .47$), indicating students *agreed* their wiki work enhanced their learning outcomes, including critical thinking, and left an imprint on the course. Students reported reading more information to construct their wiki article than they would have for an exam and coming to a deeper understanding of the content by constructing the article over reading a textbook with similar information. Students also reported critically analyzing information found before incorporating it in their wiki articles. Students believed they were helping to create course content with their wiki articles that would be used by the public.

Research Question Three

Research question three was addressed by one construct (Table 1). The mean of 2.66 (median = 3, $SD = .20$) indicated students were between *agree and not sure* if the course structure was dynamic and adaptive to allow for changing conditions. Students reported the wiki assignment allowed them to learn more about topics of interest to them, not only the prescribed curriculum.

Research Question Four

Research question four was addressed by two constructs (Table 1). The mean for both constructs was 2.47 (median = 3, $SD = .49$), indicating students were between *agree and not sure* they were producers of course content knowledge. Students enjoyed contributing original content to the course wiki and valued publishing in the wiki.

Research Question Five

Research question five was addressed by four constructs (Table 1). The mean for all four constructs was 2.17 (median = 3, $SD = .73$), indicating students were *not sure* they were involved in constructing knowledge collaboratively within a community. Students were not sure they constructed knowledge by publishing in the wiki or collaborated in a community of practice to create content.

Research Question Six

Research question six was addressed by four constructs (Table 1). The mean for all four constructs was 2.29 (median = 2.5, $SD = .66$), indicating students were *not sure* they were becoming responsible life-long learners by contributing knowledge to society. Students reported their wiki work was a meaningful learning experience and contributed to them becoming a part of the agricultural adult education community. Students felt more responsible for creating accurate work because the work was presented on the Internet and available to the public. Students gained a sense of life-long learning habits because of the wiki assignment; however, they were not sure they would contribute to the wiki after the course was over.

Research Question Seven

Research question seven was addressed by three constructs (Table 1). The mean for all three constructs was 2.25 (median = 3, $SD = .48$), indicating students were *not sure* their work was valued by others. They agreed their wiki work was recognized by the instructor but not sure the work was important or that it mattered to others. Contributing to the wiki gave students a feeling of being engaged and connected to the agricultural adult education community. Overall, students were satisfied (mean=3.09) with the wiki assignment and found it to be a positive educational experience (mean=3.21).

Table 1
Construct Measured, Research Question (RQ) Addressed, Mean, Median, and Standard Deviation for Each Construct

Construct Measured	RQ	Mean	Median	SD
1. Was student–created work used by other students for knowledge construction?	1	2.41	3	.57
2. Did students build upon other students' work in the wikibook?	1	1.91	2	.44
3. Did building an original wiki article enhance students' learning outcomes?	2	2.83	3	.16
4. Did students critically assess the information they created?	2	2.31	3	1.28
5. Did building an original wiki article give students a sense that they were leaving their imprint on the course; thus co–creating the course?	2	2.82	3	.29
6. Did building an original wiki article give students a sense that they were leaving their imprint on the agricultural adult education discipline; thus co–creating the discipline?	2	2.63	3	.24
7. Did building an original wiki article make the students more aware of the importance of teaching and education for the larger community?	2	2.75	3	.37
8. Did the students agree that the course structure was dynamic and adaptive to allow for changing conditions?	3	2.66	3	.20
9. Did students perceive themselves as producers of course content?	4	2.22	3	.75
10. Did students value publishing original information in the wikibook?	4	2.72	3	.23
11. Did students perceive themselves as being involved in the process of constructing knowledge?	5	2.35	3	.34
12. Did students perceive that they were constructing knowledge within a community?	5	2.08	3	.91
13. Did students work collaboratively to develop and distribute their work?	5	2.15	3	.53
14. How much interaction was present among student groups assigned to create wiki articles?	5	2.15	3	.53
15. Did students feel empowered as life–long learners by publishing their work in the wikibook?	6	2.00	2	.65
16. Did students perceive their work on the wikibook as deep, meaningful learning?	6	2.07	2	.92
17. Did students develop a sense of being a part of the greater community of agricultural adult education by contributing to the wikibook?	6	2.32	3	.55
18. Did students feel more responsible as a result of contributing to the wikibook?	6	2.77	3	.51
19. Did students feel that they were listened to by contributing to the wikibook?	7	2.32	3	.57
20. Did students feel that they were important to others by contributing to the wikibook?	7	2.23	3	.41
21. Did students feel needed by contributing to the wikibook?	7	2.21	3	.48
Overall Mean, Median, and Standard Deviation		2.37	2.85	.55

Note: 4=strongly agree, 3=agree, 2=not sure, 1=disagree, 0=strongly disagree

Conclusions and Recommendations for Practice

Based on the findings of the study, several conclusions were drawn about the three cohorts collectively. The overall survey mean of 2.37 (3 = agree and 2 = not sure) indicates information and communication technology, specifically wiki, positively, however marginally, enhanced students' learning outcomes and participation in an online community of practice. Holmes et al. (2001) claimed that wiki work naturally develops communal constructivism and improves critical thinking skills held true but with less exuberance than expressed by the theorists. Students were not socially involved within wiki other than to construct their articles. They preferred face-to-face and email communications to negotiate and complete the assignments, not the discussion features present in wiki. The attributes of wiki, including flexibility, collaborative writing and user friendliness did not motivate students to fully utilize this tool for co-creating course content. Instead wiki in this study was often used as a presentation tool for completed assignments rather than a working tool to create original content.

In regard to Holmes' et al. (2001) assertion one, results indicated students were not sure if their work was used by others for knowledge construction. Students developed wiki articles mostly to fulfill course requirements and were not aware if their articles were used by the public. Students were also unsure if they were building on others' work, as co-editing was the exception rather than the norm. Schwartz et al. (2003) suggested students' use of wiki in higher education may be deterred by faculty perceptions of wiki as a low quality source of information. Furthermore, through interviews with undergraduate students using a wiki, Chu (2008) found students were not comfortable editing peers' work and Lin and Kelsey (2009) reported similar findings in their interviews with graduate students in agricultural education.

In regard to Holmes' et al. (2001) assertion two, students were not sure if their work left an imprint on the course or the discipline of agricultural adult education. They agreed that developing wiki articles furthered their learning; however, they were not aware of the importance

of educating the larger community. Meishar–Tal and Gorsky (2010) observed that students add and edit content rather than delete existing text in wiki. Blank et al. (2004) and Lin and Kelsey (2009) reported when writing and editing wiki articles collaboratively, students experienced a *crisis of authority* and feared editing peers' work. It is suggested that instructors encourage students to take an active approach to writing and editing for improvement of knowledge development for future learners. It is also recommended that instructors stress the value of self-directed learning and creating knowledge for public good (Godwin–Jones, 2003). The Association of Public and Land–Grant Universities (2008) posited faculty teaching future agricultural leaders must provide them with competencies of self-directed learning and proficient information delivery in order for them to be competitive in the global economy.

In regard to Holmes' et al. (2001) assertion three, students were not sure if the course was dynamic and adaptive for changing conditions. Defining changing conditions may have helped clarify the question for students, who may not have recognized the flexibility afforded them through the wiki assignments.

In regard to Holmes' et al. (2001) assertion four, students were not sure they were producers of course content even though the entire wiki was constructed of student-created articles, nor were they sure their originally constructed information was valued. This finding does not support Holmes' et al. assertion that students *naturally* want to co-create content and publish to the Internet.

In regard to Holmes' et al. (2001) assertion five, constructing new knowledge as a part of a group was not important to students. Students were not sure if they were constructing new knowledge in a community. Blank et al. (2004) noted students were territorial, which prevented them from working collaboratively in a wiki environment. Roberts et al. (2010) found that agricultural education student teachers preferred face-to-face, telephone, email and text communications over social networking sites such as Facebook or MySpace to connect with peers. Community was built in private and synchronous spaces, rather than public and asynchronous spaces. In short, Holmes' et al.

assertion that collaborative learning and work increases as a result of using wiki was not the case in this study. In this study, learning communities were not created online among these three cohorts in contrast to Alston and Warren English's (2007) finding that web-enhanced courses were "an effective means of communication between...student to student" (p. 7). It is recommended that instructors monitor and provide timely feedback to students on group well-being, parameters of participation, and interaction as these factors are important to foster collaborative behavior and knowledge building (Zumbach, Reimann, & Koch, 2006).

In regard to Holmes' et al. (2001) assertion six, students were not sure if they were empowered as life-long learners as a result of publishing work in wiki. Since students were not sure of their learning outcomes, it is possible only "surface-level thinking" occurred as in Engstrom and Jewett's study (2005, p. 15). Additionally, students were not sure if they were more civically engaged as a result of contributing to wiki. Despite Edwards' (2002) claim, students in this cohort study indicated they did not establish learning communities online by contributing to wiki even when working in teams on specific articles. Furthermore, learning through wiki was not considered superior to learning from an instructor. Similar to Edwards' findings, students noted that knowledge was not constructed through dialogue with others while working on wiki articles. However, students indicated knowledge constructed was useful for their professional careers, which is similar to Edwards' findings. Moreover, students were not sure if they further developed critical thinking skills or provided content for public good as a result of developing wiki articles as posited by Goodwin–Jones (2003).

In regard to Holmes' et al. (2001) assertion seven, students were not sure if their contributions would "be listened to and [considered] important to others" (p. 7). Since all students were new to the practice of developing wiki articles, they were not sure if they were satisfied with creating content for wiki, nor were they sure if they were proud of wiki content. Thus, the assumption that writing in wiki and making wiki available to the public influences student motivation to produce high quality and accurate products was not verified in

this study. This study found that wiki and online communication were not fully utilized.

Students in this study were not sure if wiki had an effect on their learning outcomes. Similar to Robertson (2008) and Roberts, et al.'s (2010) findings, students found that communicating with peers via wiki was not as efficient as email or other communication technologies. Furthermore, as Blank et al. (2004) and Lin and Kelsey (2009) discovered, students' territorial needs caused wiki work to be less than collaborative. The face-to-face classroom communication may also have contributed to a lack of interaction online. Students perceived they marginally used wiki to create course knowledge and may need time to grow accustomed to contributing in such a manner, as well as recognizing the contributions made in wiki as valuable and important.

In summary, this study examined the pedagogical promise of wiki based on Holmes' et al. (2001) theory of communal constructivism. Assertions of enhanced collaborative learning via wiki made by others (Edwards, 2002; Freeman et al., 2001; Goodwin–Jones, 2003; Hammond, 2002) were mostly unfounded. Students' assessment of their contributions to wiki was less idealistic and pronounced than the assertions of the communal constructivism theory.

It is recommended that instructors encourage and model collaborative writing to prompt students' critical thinking and decision-making skills (Engstrom & Jewett, 2005) so students may gradually adapt to the modality of the student-oriented learning mode afforded by wiki. This study spanned three years and examined agricultural education students' perceptions of using wiki as a collaborative writing tool. As more instructors and researchers explore how ICT improve the effectiveness and efficiency of teaching and learning, this study lays the groundwork for further research on collaborative learning in wiki.

While this study provides insight to students' perceptions of using wiki, it was limited by the small sample of agricultural education graduate students. In addition, since the course was focused on agricultural adult education theory and practice and stressed self-directed learning in a Web environment as a virtue, the findings may be confounded by such

factors as students' perceptions of using a new piece of instructional technology and the likes and dislikes of the course content. Robertson (2008) noted that having the ability to communicate in person or via email prevented complete online wiki discussion; thus, hindering collaboration.

Future research should examine (a) if wiki is the ideal Web 2.0 tool for creating communities of practice and delivering content given Cooperative Extension's investment in eXtension.org (Harder & Lindner, 2008) and AAAE efforts to co-create and disseminate information (<http://aaae.wikispaces.com>), and

(b) whether wiki is more suitable for distant collaborators as they must rely on ICT for communication rather than those afforded face-to-face interactions.

Additionally, other agricultural adult education courses delivered through land-grant universities could contribute to wiki, affording it permanence and prestige, which may result in deepening future students' commitment to contributing to the online textbook. The authors invite collaboration within the agricultural education community to further develop *All Things Adult Education Wikibook* (<http://adulthoodeducation.wikibook.us>).

References

- Alston, A. J., & Warren English, C. (2007). Technology enhanced agricultural education learning environments: An assessment of student perceptions. *Journal of Agricultural Education*, 48(4), 1–10. doi: [10.5032/jae.2007.04001](https://doi.org/10.5032/jae.2007.04001)
- Association of Public and Land–Grant Universities. (2008). *Human capacity development: The road to global competitiveness and leadership in food, agriculture, natural resources, and related sciences (FANRRS)*. Retrieved from <http://www.aplu.org/NetCommunity/Document.Doc?id=1639>
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice–Hall, Inc.
- Blank, D., Cassidy, K., Dalke, A., & Grobstein, P. (2004). Emergent pedagogy: Learning to enjoy the uncontrollable and make it productive. Retrieved from http://serendip.brynmawr.edu/sci_edu/emergentpedagogy.html
- Camp, W. G. (2010). Toward an intellectual common for agricultural education. *Journal of Agricultural Education*, 51(1), 1–10. doi: [10.5032/jae.2010.01001](https://doi.org/10.5032/jae.2010.01001)
- Chu, S. K–W. (2008). TWiki for knowledge building and management. *Online Information Review*, 32(6), 745–758.
- Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson Education, Inc.
- Edwards, C. (2002, March). *Discourses on collaborative networked learning*. Paper presented at the International Conference on Networked Learning, University of Sheffield, England. Retrieved from <http://www.networkedlearningconference.org.uk/past/nlc2002/proceedings/symp/05.htm#05a>
- Engstrom, M. E., & Jewett, D. (2005). Collaborative learning the wiki way. *TechTrends*, 49(6), 12–15, 68.
- Freeman, E., Holmes, B. & Tangney, B. (2001). ICTs for learning: An international perspective on the Irish initiative. In J. Price et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2001* (pp. 1269–1274). Chesapeake, VA: AACE. Retrieved from <http://www.editlib.org/p/16916>.

- Fuchs–Kittowski, F., & Kohler, A. (2005, October). *Wiki communities in the context of work processes*. Paper presented at the 2005 International Symposium on Wikis. ACM Press, San Diego, CA. Retrieved from <http://www.wikisym.org/ws2005/proceedings/>
- Godwin–Jones, B. (2003). Blogs and wikis: Environments for on–line collaboration. *Language, Learning and Technology*, 7(2), 12–16. Retrieved from <http://llt.msu.edu/default.html>
- Hammond, M. (2002, March). *Construction of professional knowledge within an on–line environment: The case of teacher on–line forums*. Paper presented at the International Conference on Networked Learning, University of Sheffield, England. Retrieved from <http://www.networkedlearningconference.org.uk/past/nlc2002/>
- Harder, A., & Lindner, J. R. (2008). An assessment of county extension agents' adoption of extension. *Journal of Extension*, 46(3), 3RIB1.
- Holmes, B., Tangney, B., FitzGibbon, A., Savage, T., & Mehan, S. (2001, March). *Communal constructivism: Students constructing learning for as well as with others*. Paper presented at the 12th International Conference of the Society for Information Technology & Teacher Education (SITE 2001), Charlottesville, VA.
- Kotrlik, J. W., & Redmann, R. H. (2009). A trend study: Technology adoption in the teaching–learning process by secondary agriscience teachers–2002–2007. *Journal of Agricultural Education*, 50(2), 62–74. doi: [10.5032/jae.2009.02062](https://doi.org/10.5032/jae.2009.02062)
- Lin, H., & Kelsey, K. D. (2009). Building networked learning in wikis: The evolving phases of collaborative learning in a wiki project. *Journal of Educational Computing Research* 40(2), 141–165.
- McKibben, D., McDonald, S., Holmes, B., & Tangney, B. (2001, March). *Reflections on the impact of ICT on teacher education*. Paper presented at the 12th International Conference of the Society for Information Technology & Teacher Education (SITE 2001), Charlottesville, VA.
- Meehan, S., Holmes, B., & Tangney, B. (2001). Who wants to be a teacher? An exploration of the theory of Communal Constructivism at the chalk face. *Teacher Development*, 5(2), 177–190.
- Meishar–Tal, H., & Gorsky, P. (2010). Wikis: What students do and do not do when writing collaboratively. *Open Learning*, 25(10), 25–35.
- Roberts, T. G., Murphy, T. H., & Edgar, D. W. (2010). Exploring interaction between student teachers during the student teaching experience. *Journal of Agricultural Education*, 51(1), 113–125. doi: [10.5032/jae.2010.01113](https://doi.org/10.5032/jae.2010.01113)
- Robertson, I. (2008). Learners' attitudes to wiki technology in problem based, blended learning for vocational teacher education. *Australian Journal of Educational Technology*, 24(4), 425–441.
- Schwartz, L., Clark, S., Cossarin, M, & Rudolph, J. (2003). *Educational wikis: Features and selection criteria*. Athabasca University, Centre for Distance Education, Report # R27/0311.
- Sharma, P., & Hannafin, M. J. (2007). Scaffolding in technology–enhanced learning environment. *Interactive Learning Environment*, 15(1), 27–46.
- Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wang, Q. (2009). Designing a web–based constructivist learning environment. *Interactive Learning Environment, 17*(1), 1–13.

Zumbach, J., Reimann, P., & Koch, S. (2006). Monitoring students' collaboration in computer–mediated collaborative problem–solving: Applied feedback approaches. *Journal of Educational Computing Research, 35*(4), 399–424.

KATHLEEN D. KELSEY is a Professor in the Department of Agricultural Education, Communications and Leadership at Oklahoma State University, 466 Agriculture Hall, Stillwater, OK 74078. Kathleen.kelsey@okstate.edu

HONG LIN is the Faculty Development Manager for the Institute for Teaching and Learning Excellence, Oklahoma State University, 1000 Telecommunications, Stillwater, OK 74078. Hong.lin@okstate.edu

TANYA C. FRANKE–DVORAK is an Education Officer, Biosecurity Research Institute, Kansas State University, 1041 Pat Roberts Hall, Manhattan, KS 66506. TCDvorak@bri.ksu.edu