Crowdteaching: Online Crowdsourcing in Education

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Abstract: Web 2.0 technologies have generated massive new opportunities for teachers to collaborate and to improve as professionals (Dron & Anderson, 2014; Laferrière, Lamon, & Chan, 2006; Wenger, 2006). While much literature discusses offline communities of practice among teachers, and additional literature discusses how students use online learning, there is a gap in literature about online professional improvement practices among teachers (Hsu, Yu-Chang, Ching, Yu Hui, & Grabowski, 2014). This paper discusses distributed cognition as a theoretical basis for crowdteaching, how teachers currently use crowdteaching, and how crowdteaching can be optimized in order to promote professional improvement. Methods included studying three databases to establish an initial repository, data mining relevant studies for additional resources, collaborating with colleagues, and revisiting databases using a new set of terms that emerged. The review found that teachers currently use crowdteaching to communicate both informally and formally for information as well as emotional support, and to gather, develop, and share information and resources (Booth, 2012; Brooks & Gibson, 2012; Dron & Anderson, 2014; Hsu et al., 2014; Marrero, Woodruff, Schuster, & Riccio, 2010).

Background: Crowdteaching as a Solution

Prior to the advent of Web 2.0 technologies, teachers were largely limited to classroom materials, materials from teacher supply stores, and collaboration within a school (Brooks & Gibson, 2012). Professional development has traditionally involved schools or districts paying for experts to fly to schools; or teachers flying to conferences to hear experts speak. Most speeches foster little interaction, and they do not feature continued help over time. Instruction has been compared to an “expert-patient relationship” (Brooks & Gibson, 2012, p. 11), and workshops have been described as fractured, ineffective, and

irrelevant to teachers and their students (Brooks & Gibson, 2012; Marrero et al, 2010).

Web 2.0 technologies provide avenues for distributing knowledge and developing meaningful, authentic communities of practice featuring self-guided learning, peer-support, the ability to openly exchange ideas and resources, and the opportunity to add to collective insights in an ongoing fashion (Bell-Robertson, 2014; Booth, 2012; Brooks & Gibson, 2012; Dron & Anderson, 2014; Hsu et al., 2014; Marrero et al., 2010; Ranieri, Manca, and Fini, 2012). This ability to collaborate online has been dubbed "crowdteaching" (Recker, Yuan, & Ye, 2014).

Online professional improvement for teachers has gained support from government officials and teachers alike. The U.S. Department of Education's National Education Technology Plan indicates that online communities of practice should be used to help pre-service teachers, educators, and professional organizations throughout their careers (Booth, 2012). In a survey of 118 beginning teachers who were asked to rank six types of support from most to least helpful, the teachers rated "support from online resources" second to "support from my school (mentoring)" (Kelly, Reushle, Chakrabarty, & Kinnane, 2014). Teachers who voluntarily join online communities have indicated that these groups can give teachers opportunities for continuous interaction, in a setting where they can learn from others, exchange ideas, share emotions, benefit from an anonymous environment, and feel a sense of camaraderie (Hur & Brush, 2009).

Purpose Statement

The purpose of this literature review is to use the Theory of Distributed Cognition (Hutchins, 2002) as a theoretical framework for exploring how teachers currently use crowdteaching, and to learn how crowdteaching can be optimized in order to promote professional improvement.

Research Questions

Within the theoretical framework of the Theory of Distributed Cognition, the authors ask:

1. How are teachers currently using crowdteaching to improve professional practice?

2. How can crowdteaching be optimized in order to promote professional improvement?

Methods

The authors studied the Google Scholar, Eric, and OneSearch Manoa databases in order to establish an initial repository. These databases were chosen since they are commonly used for education-related inquiries. They first used the terms "crowdsourcing" and "education;" along with "crowdsourcing," "teachers," and "learning." They next mined relevant studies for additional resources, collaborated with each other on results, and

revisited databases using a new set of terms that emerged. Sample terms included "online communities of practice," "online collaboration," and "collective intelligence communities." Articles were reviewed to identify specific online activities and continued until we had at least two sources for each activity, as recommended by Yin (2014).

Finally, types of activities were evaluated to determine if they fit the emerging definition for crowdteaching. The activity must involve teachers, who collaborate online, for the purpose of improving professional practice (See Appendix A, Figure 1). Websites and studies were considered in the context of these criteria. Pinterest, for example, is a social media site in which users collect images, group them in chosen themes, and interact with each others' boards by "liking," "repinning," commenting on, or clicking images to find other links (Pearce & Learmonth, 2013). Teachers use Pinterest for such activities as finding resources, managing resources, and sharing resources (Grote-Garcia & Vasinda, 2014, p. 43). This site qualifies as being a place where teachers collaborate asynchronously, using the Internet, for the purpose of improving professional practice. On the other hand, crowdfunding, an activity that involves raising money for a classroom online, does not involve collaboration between teachers for professional improvement. While crowdfunding can be an important mechanism for allowing teachers to choose resources for their classrooms, the lack of professional collaboration disqualifies it from the definition. Other activities that met the criteria for inclusion included blogging, Teachers Pay Teachers, wikis, Facebook, and MOOCs.

The Theory of Distributed Cognition (Hutchins, 1995)

The theoretical framework this literature review used was Edward Hutchins' Theory of Distributed Cognition (1995). This theory posits that knowledge can be distributed across individuals in a group, in material objects or artifacts in the environment, and across time. According to R. J. MacDonald, "The notion of distributed cognition suggests that when diverse teachers with different expertise come together, they can draw upon each other's expertise and create new insights into teaching and learning" (MacDonald, 2008, p. 432).

The first part of Hutchins' theory relates to knowledge that is distributed across people. Hutchins' distributed cognition, when applied online, comes in the form of synchronous and asynchronous communication with individuals in informal or formal communities of practice.

The second part of the distributed cognition theory is that people develop cognition through interaction with artifacts (Hutchins, 2000). Virtual artifacts may come in the form of audio or visual displays, along with products or printable objects to be used in the classroom.

Third, cognition is distributed over time (Hutchins, 2000) in such a way that prior events can influence the future (Hollan, Hutchins, & Kirsch, 2000; Hutchins, 2000). We would argue that the time for improving collective intelligence has the potential to multiply far faster through online platforms than cognition that is distributed within a defined physical space, making this a major reason for choosing distributed cognition as a theoretical

framework. The relationship between the theoretical framework, research questions, and findings are shown in Appendix B, Figure 2. Explanations of some of the terms used (e.g crowdsourcing and crowdteaching) will be reviewed prior to reviewing findings.

Crowdsourcing

"Crowdsourcing" is an emerging term that "may be identified with virtually any type of Internet-based collaborative activity" (Estellés-Arolas & Gonza´lez-Ladro´n-de-Guevara, 2012). Multiple conflicting definitions of crowdsourcing exist. Estellés-Arolas and Gonza´lez-Ladro´n-de-Guevara (2012) used the Delgado approach to develop a globally acceptable definition of crowdsourcing. They studied six databases to establish an initial repository, then created an expanded repository by giving extra credence to the most cited sources as well as those created by experts in the field. The authors concluded that crowdsourcing consists of an individual or institution, with a goal to carry out an objective, and uses online interactions and crowd participation to meet that objective (Estellés-Arolas & Gonza´lez-Ladro´n-de-Guevara, 2012).

Crowdteaching

Recker, Luan, and Ye (2014) looked at teachers who use crowdsourced information to improve as professionals (2014). They coined the term *crowdteaching* to refer to teachers who use web-based content to design curricula, design classroom activities, share creations, learn from peers, and support each other through crowdsourced communities (Recker et al., 2014). In other words, teachers engaged in crowdteaching use the distributed cognition available online to improve professional practice (Laferrière, Lamon, & Chan, 2006).

How Teachers Use Crowdteaching to Improve Professional Practice

Based on our review of literature, we found examples of teachers using distributed cognition across individuals, materials, and time to improve professional practice. These are discussed briefly here with examples of online tools to support this activity.

Promoting distributed cognition across individuals in groups is possible from a range of informal to formal online settings. Research indicates that educators use online tools to share ideas, share projects, get visibility for ideas, advertise initiatives, help others, and gain emotional support (Barczyk & Duncan, 2013; Bell-Robertson, 2014; Hur & Brush, 2009; Ranieri, Manca, & Fini, 2012). Characteristics of successful online groups include those with a clear purpose, a common identity, opportunities for learning, involvement of a trusted moderator, supportive members, and enforcement of acceptable online behavior (Booth, 2012). For example, Facebook, blogs, vlogs, and MOOCs can be used to distribute knowledge.

Informal social networking sites such as Facebook have shown positive outcomes for emotional support and emerging research hints at its effectiveness in promoting professional learning (Ranieri, et. al., 2012, p. 756). Blogs (web logs) and Vlogs (video

logs) are more focused platforms in which teachers can read about and respond to colleagues' ideas (Raths, 2013). A study of pre-service teachers indicated value in creating blogs, including community-building skills, cognitive skills, and metacognitive skills (Hsu et al., 2014). Students benefited from reading others' blogs, even if they didn't directly comment or interact (Hsu et al., 2014). Massive Open Online Courses (MOOCs) are also used for professional development by teachers. These range from tutorial versions, such as Khan Academy, eHow, HowStuffWorks, LifeHacker, and Ted Talks; to organized classes (Dron & Anderson, 2014).

Other courses that integrate both formal and informal learning have offered promising potential for online distributed cognition within groups. For example, NASA's Office of Education and National Explorer Schools Project funded a series of live, online one-hour "short-courses," created by the U.S. Satellite Laboratory. The courses were designed to facilitate collaboration with other teachers and scientists across the U.S. Participants were encouraged to share and ask questions during classes, and were able to call or e-mail instructors between classes. Participants indicated that they benefitted from the flexible structure along with the ability to interact with others. (Marrero et al., 2010). Another example is the Ontario Consortium of Undergraduate Biology Educators (oCUBE), which uses a mix of face-to-face meetings with online tools to interact with educators from eighteen universities in Ontario to improve teaching. Educators interact on a wiki site, at annual UnConferences, in a journal club, through vitual meetings online, in newsletters, and by conducting collaborative research projects (Kajiura, 2014).

Distributed cognition relates to material objects when content is created or curated online. Little research has been conducted on teachers' use of content creation or content curation sites for the purpose of professional improvement (Irvine, 2015; Pearce & Learmonth, 2013). Collecting quantitative data on these sites can be challenging, since not all aspects of use are recorded, e.g., there is no view counter (Pearce & Learmonth, 2013). There are several examples of sites teachers used to share materials.

One study indicated teachers used Teachers Pay Teachers and Pinterest to find materials related to content areas, collaborate through comments and questions, and share ways to use materials (Irvine, 2015). Another study (Recker, et. al, 2014) focused on Instructional Architect (IA), a site created to study teachers' decisions to use online sources when creating, sharing, and finding instructional materials. Teachers used or modified open education resources (OERs) in their projects from sources like TeacherTube, the Khan Academy, the National Science Digital Library (NSDL.org), the OER Commons, and OpenCourseWare. The researchers found that teachers on average shared almost two thirds of their own projects, viewed others, and copied from "a small portion" of OER projects as well (Recker et al., 2014, p. 154). The researchers concluded that the teachers were building knowledge as both contributors and consumers through this process (Recker et al., 2014, p. 154).

Finally, according to Dron and Anderson (2014), the immediate power of the crowd to validate and interact with blog posts may potentially yield greater value than a peer-reviewed article that took two years to publish, and in which responses or dialogue can be

greatly delayed (p. 310). They indicated that sharing knowledge over time through social networking sites, blogs, groups, file sharing, social bookmarking, wikis, and content curation sites can be instrumental in expanding learning possibilities. They recommended Moodle, Blackboard and Desire2Learn as "highly evolved" networking tools in that they have features like Wikis and blogs, but are designed and intended to support groups (Dron & Anderson, 2014, p. 276-277).

Optimizing Crowdteaching to Promote Professional Improvement

Optimizing crowdteaching includes addressing a number of technical issues such as ownership of content, privacy, safety, out-of-control feedback loops, reliability, access, and usability (Dron & Anderson, 2014) as well as social issues. Teachers are often expected to collaborate, but are evaluated individually and even on a competitive basis. This social dynamic might lead to creating cliques that exclude new members or engaging in group-think that limits new ideas (Li, L. C., Grimshaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009). However, the key issue seen in the literature is with curating quality content (Irvine, 2015; Kelly et al., 2014; Malone et al., 2009; Pearce & Learmonth, 2013). While there are millions of teaching resources to *collect* on the Internet, *curating* refers to critically choosing quality materials that meet specific needs (Grote-Garcia & Vasinda, 2014; Malone et al., 2009; Porcello & Hsi, 2013). Incentives, training, and better use of meta-data may help address the curation issue.

Some sites use specific criteria before accepting materials, including NASAWavelength.org and CPALMS, for Florida K-12 teachers (Porcello & Hsi, 2013, p. 241). But for most, that is not the case. Creating incentives for ratings may promote quality curation. Teachers' online use of materials can be an indication of quality. Users leave a "digital footprint" when they rate materials or organize them into personal collections. (Porcello & Hsi, 2013). Studies of collective intelligence sites like Wikipedia suggest that incentives to harness quality contributors are important (Malone et al., 2009). Researchers are currently piloting an online incentivized community for beginning teachers based on the model of StackFlow (Kelly, Reushle, Chakrabarty, & Kinnane, 2014). This online support network includes opportunities for community engagement and a scoring system. Volunteers answer questions, and receive points and positive online reputations as "payment." As of a 2014 article, 2,000,000 users answered over 5,800,000 questions within 11 minutes (Kelly et al., 2014).

While incentives can help to promote quality curation, studies indicate that teacher training may also be beneficial. According to a national survey of K-12 schools, over 50 percent of teachers indicated that "the most important factors in evaluating content were 'being referred by a colleague,' 'free,' and 'created by educators', none of which is necessarily a hallmark of quality" (Porcello & Hsi, 2013, p. 240). One proposed solution is to train preservice educators to critically evaluate materials: "We suggest that educators be equipped with the knowledge and skills to peer-review the materials posted on these sites" (Gote-Garcia & Vasinda, 2014, p. 43).

In the end, there is perhaps a need for a new specialized profession—a cyber-librarian, or "cybrarian," to take on the curation task (Porcello & Hsi, 2013). Cybrarians could use common metadata, or terms, to characterize like materials, so that users could quickly find what they need.

Areas for Further Research

Crowdteaching is a developing phenomenon that offers extensive possibilities for the future of education. The main issue with prior research is simply that it is lacking. Areas for further research include understanding teacher practices in informal communities like Facebook, determining best practices in online professional development, and developing strategies for quality content curation. Since advertised products may impact purchasing decisions and "digital footprints," the use of advertisements is an area for further exploration as well. Finally, while crowdfunding did not fit into the realm of this study, it is certainly an area for further inquiry, since funds can allow distributed cognition to materialize in classrooms (Althoff & Leskovec, 2015).

Conclusion

While once teachers had to attend professional development seminars or search through stores for ideas and resources, they now can find them—or create them—faster than ever before. Crowdteaching has tremendous potential for transforming the way teachers practice. As researchers study and refine existing systems, a higher and higher-quality world of distributed cognition can become increasingly accessible at every teacher's fingertips.

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Appendix A

Figure 1: Activities That Qualify as Crowdteaching

What Activities Qualify As Crowdteaching?							
	Blog	TpT	Pinterest	Wiki	Face Book	P.D./ MOOCs	Crowdfunding
Teachers	✓	✓	✓	✓	✓	✓	(usually one)
Collaborate	✓	✓	✓	✓	✓	✓	✗
Use Internet	✓	✓	✓	✓	✓	✓	✓
Improve Professional Practice	✓	✓	✓	✓	✓	✓	✓

Appendix B

Figure 2: Crowdteaching Theoretical Framework