British Journal of Educational Technology *Vol 42 No 4 2011* 583–591
doi:10.1111/j.1467-8535.2010.01112.x

Asynchronous and synchronous online teaching: Perspectives of Canadian high school distance education teachers

Elizabeth Murphy, María A. Rodríguez-Manzanares and Michael Barbour

Elizabeth Murphy holds a PhD in educational technology from Université Laval, Québec, Canada. She is an associate professor in the Faculty of Education at Memorial University of Newfoundland, Canada; María A. Rodríguez-Manzanares is a doctoral candidate in the Faculty of Education at Memorial University of Newfoundland and a lecturer in the university's Department of French and Spanish and Faculty of Education. Her areas of interest include technology-enhanced learning, second- and foreign-language learning and international students; Michael K. Barbour is an assistant professor of Instructional Technology at Wayne State University in Detroit, Michigan. Originally from Newfoundland, Canada, Michael received his PhD from the University of Georgia. His research interests focus on the use of online learning to provide equitable learning opportunities for K-12 students in rural jurisdictions. Address for correspondence: Elizabeth Murphy, Associate Professor, Faculty of Education, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X8, Canada. Email: emurphy@mun.ca

Abstract

This paper presents the results of an inductive, interpretive analysis of the perspectives of 42 Canadian high school distance education (DE) teachers on asynchronous and synchronous online teaching. The paper includes a conceptual overview of the affordances and constraints of each form of teaching. Findings provided insight into the following aspects of asynchronous and synchronous online teaching: degree of use; the tools used; the contexts in which each occur; students' preferences; and limitations. Pedagogy emerged as more important than media for both asynchronous and synchronous online teaching. Synchronous online teaching relied on teacher- rather than student-centred approaches. Asynchronous online teaching provided support for self-paced, highly independent forms of secondary DE supplemented by synchronous online teaching for answering questions and troubleshooting.

Introduction

Distance education (DE) at the secondary (high school) level in Canada and the United States takes place in web-based learning programmes organised into single entities or schools that provide supplemental or full-time online studies, often referred to as virtual schools (Powell & Patrick, 2006). Virtual schools rely on both asynchronous online teaching (AOT) or synchronous online teaching (SOT). One of the difficulties in examining these approaches to teaching in virtual schools is the general lack of research that has been conducted into DE at this level and in kindergarten to grade 12 (K-12) in general. While there has been a shift towards more empirical research into the practice of virtual schools, the vast majority of this research has been conducted in the United States (Barbour & Stewart, 2008) and is limited largely to practitioner reports and issues surrounding policies or technologies (Cavanaugh, Barbour & Clark, 2009). Furthermore, early research on virtual schools has tended to focus on their effectiveness compared with classroom-based practices, as opposed to on design and delivery issues.

The education system in Canada is regulated at the provincial level. As a result, there is no one uniform approach to the organisation or delivery of DE at the secondary level (see Abrami *et al*, 2007; Barbour & Stewart, 2008; Barker & Wendel, 2001; Canadian Council on Learning, 2009; Haughey, 2002a, 2002b; Haughey & Muirhead, 2004). This lack of uniformity presents an

opportunity to survey perspectives based on a variety of contexts and approaches related to AOT and SOT.

This paper presents the results of an inductive, interpretive analysis of the perspectives of 42 Canadian high school DE teachers on AOT and SOT. The paper begins with a conceptual overview of AOT and SOT in terms of affordances and constraints and a review of studies conducted in relation to the two approaches. Findings provide insight into the following aspects of AOT and SOT: degree of use; the tools used; the contexts in which each occur; students' preferences; and limitations.

Conceptual framework

AOT

AOT involves students working with online curricular materials on their own time, under the guidance of a teacher (Friend & Johnston, 2005; Zucker & Kozma, 2003). The teacher and students are separated in time and space and are, therefore, geographically and temporally independent and diverse. There are no geographic or temporal constraints. Tools that can support AOT include email, content material, discussion forums, fax machines and social media such as blogs and wikis. A suite of these tools may be housed within a learning management system, such as WebCT™, Moodle™ or BlackBoard™. AOT tends to be primarily dependent on text and voice independent except when audio recordings are used. It is typically not visually dependent in that teachers and students cannot see each other unless recorded video or images are made available. Bernard *et al* (2004) characterised AOT as 'individually-based' (p. 387) DE.

SOT

In some respects, SOT, whereby students are located in a remote location, and connected by videoconferencing, audio conferencing or both, is 'more like classroom instruction' (Bernard *et al*, 2004, p. 409) than is AOT. Unlike with AOT, teachers and students are temporally dependent, which means that they must schedule their presence to coincide. However, as with AOT, the teacher and students can be geographically diverse and independent. Teachers and students may be located in rooms that are thousands of miles apart and yet still spontaneously communicate together as if they were physically co-present. There are no geographic constraints; however, there are temporal constraints.

Tools that can support SOT include text-based chat (eg, instant messaging), analogue telephone, digital telephone using Voice over Internet Protocol (eg, Skype™), video conferencing, audio conferencing, whiteboards and application sharing. A suite of these tools may be accessed together using real-time communication and collaboration software such as Elluminate Live™ or Wimba™. SOT is largely dependent on voice and textual elements (eg, chat and whiteboard). When video conferencing and/or when webcams are used, SOT is voice and visually dependent. Some SOT software provides an ability to record the synchronous interactions and communication for asynchronous playback (eg, Elluminate Live™).

Review of the literature

We uncovered few studies that included a focus on both AOT and SOT. Of those studies that do focus on both forms, they may do so solely in the context of use of one tool. A good example of this type is Johnson's (2008) study of a group of students' perceptions of the 'learning advantage of real-time versus delayed-time text-based communication' (p. 167). Another example is Roblyer *et al*'s (2007) comparison of web-based asynchronous versus synchronous videoconferencing. Our review does not include studies of either, such as DiPietro, Ferdig, Black and Preston (2008), which focused on best practices in K-12 asynchronous teaching.

Bernard *et al* (2004) concluded that, in terms of achievement and attitude outcomes, asynchronous environments had more positive effects than synchronous ones. In spite of the positive

outcomes for asynchronous instruction, the authors also found that retention rates were lower and dropout rates substantially higher in asynchronous versus synchronous DE. Media appeared to be more important in synchronous DE, while pedagogy was more important for asynchronous DE. In general, they concluded that synchronous DE represented 'a poorer-quality replication of classroom instruction' (p. 408).

They noted that synchronous instruction lacked the flexibility in relation to scheduling, place of learning and individual attention which might be found in asynchronous DE. They questioned the effectiveness of teleconferencing, citing instructors' tendency for 'lecture based, instructor-oriented strategies' (Bernard *et al*, 2004, p. 408). The authors noted that 'for younger learners, the structure of synchronous DE may be better suited to their academic schedules and their need for spontaneous guidance and feedback' (p. 409). In terms of 'what matters' with synchronous versus asynchronous DE, Bernard *et al* concluded that quality in the design of the course was more important than the characteristics of media, although interactive media appeared to facilitate better attitudes in asynchronous DE. For asynchronous DE, active learning was linked with positive achievement and attitude outcomes, while opportunities for communication positively affected students in both contexts of DE.

Hrastinski (2008) analysed asynchronous and synchronous online seminars in two ($n = 8$ and $n = 19$) e-learning classes at the post-secondary level. He also interviewed students on their opinions with regards to the two forms. He relied on both qualitative and quantitative measures of students' perceived and actual participation using synchronous communication (chat), as a complement to asynchronous communication (discussion forum) in online education. He concluded that, while the two forms complemented each other, asynchronous e-learning better supported cognitive participation such as increased reflection, but synchronous e-learning better supported increased motivation.

In an earlier publication based on the same study (see Hrastinski, 2007), the author categorised participation into one of two dimensions: personal participation and cognitive participation. Synchronous communication appeared to support personal participation, including motivation and 'increased convergence on meaning', social relations and the exchange of information with a lower degree of complexity than what would be communicated with asynchronous communication. Hrastinski also noted the following regarding each form: 'Asynchronous communication may induce increased cognitive effort since students have more time for reflection. Synchronous communication may induce increased motivation and decreased ambiguity because of possibilities for immediate feedback' (p. 45).

Methods

Participants

Participants were recruited from western (British Columbia, Alberta, Saskatchewan, and Manitoba), central (Ontario and Quebec) and eastern areas (New Brunswick and Nova Scotia) of Canada (11, 21, and 10 participants, respectively). They taught from various locations, including physical schools, their home office or an office located elsewhere. One of the teachers was employed by a private institution, whereas all the others worked in the public school system. Three out of the 42 teachers had previously taught in correspondence mode, one had taught using videoconferencing and the other 38 had taught in an online setting.

Data collection

Data collection relied on individual semi-structured (Patton, 2002) 1-hour phone interviews. Questions focused on a variety of aspects of the participants' teaching, one of which was the asynchronous/synchronous aspect. It is this aspect that is reported on in this paper. The questions

related to the following: the systems and tools used; time spent on AOT versus SOT; the circumstances/contexts in which AOT and SOT take place; and the types of interactions with students with AOT and SOT.

Data analysis

Once all the interviews had been conducted and transcribed, the transcript underwent a series of reviews and analyses. The first review involved reducing the data by eliminating any portions of the transcription not directly related to the topic. This reduction was followed by repeated rereading of the transcripts. Next, we broke the transcript into units of meaning, that is, 'a statement or a continuous set of statements, which convey one identifiable idea' (Aviv, 2001, p. 59). Units were no shorter than a sentence and typically no longer than one short paragraph. Each time the teacher changed the topic represented a separate unit of meaning.

We then grouped all units into either one of two main categories: AOT and SOT. Keywords, particularly those referring to specific electronic tools such as 'email' or 'discussion forums,' played a role in the decision to group a unit into one category or the other. Breaking the units down into keywords and concepts involved what Strauss and Corbin (1998) refer to as open coding. Open coding was followed by axial coding (Strauss & Corbin, 1998), which involved grouping the data. Identification of patterns allowed us to reduce the data further by combining like units.

Findings

Degree of AOT versus SOT

Twelve teachers (28.5%) indicated that they conduct their courses 100% asynchronously with absolutely no synchronous components. Fifteen teachers (35.7%) stated they 'mostly' teach asynchronously. Teachers who described using some form of SOT referred to scheduled office hours and class times, as well as instances when students initiate a synchronous interaction to receive tutoring or simply to have a 'chat.' These situations can occur one-on-one between teacher and student or between the teacher and a group of students. In a small number of cases, teachers commented that they are required by policy to have a certain number of (eg, two) synchronous sessions per week either using chat or a synchronous online class.

For none of the 42 teachers interviewed was there one instance of DE that relied solely on SOT. Instead, teachers relied on a combination of SOT and AOT. Some cases of teaching were, as a rule, entirely asynchronous; however, contact with students, on rare occasions, might be made synchronously. Our data clearly indicated a more general reliance on AOT supplemented with SOT.

Tools for SOT

One teacher described using the whiteboard as follows: 'They [students] see my desktop when we go to the … conferencing and they have the ability to write on my desktop. So, not only is it visual and oral, they can actually write things and interact with questions.' Another teacher referred to his use of the whiteboard with his online students:

> … I can write problems down, just as I would on a piece of paper or on a chalkboard and the student can see exactly what I'm writing. There's also the ability there to instant message and, if the student has microphone and speakers, we can talk and listen to each other as well.

Courses may be delivered using interactive television to allow a teacher in one school, for example, to teach a Math course to students in other schools whereby students '…. can hear and see the teacher; the teacher can hear and see them; they can ask the teacher any questions at any time.' In some cases, to reduce background noise and 'interference,' students may be required to only turn on their microphones 'when they have specific questions.' Background noises may be

'quite disturbing to the students and they can't listen with what's going on in class.' Interactive television can allow a teacher to see each class and have students see other classes as well as to connect communities.

Tools for AOT

In contexts of AOT where learning management systems are used, students may have assigned textbook readings, links to sites where they can watch a video or 'where they can read some information'. There may also be online quizzes for students to take and 'get the feedback right away'. In other cases, there may be 'a lot of independent research where the students are expected to find the answers to the questions on their own' or to go to textbooks 'for questions that they have to answer'. If they have a question, they can email their teacher. When students sign up for a DE course, they may receive a combination of textbook, pre-recorded lessons, homework, assignments and even an experiment kit for science courses.

One of the 42 teachers referred to use of a wiki whereby students worked in groups of two to complete an assignment. Another teacher noted: 'Sometimes they [students] have to post their thoughts, their ideas, their reactions in an area that all other students will see, something like a blog or a wiki'. A more commonly used AOT tool among the participating teachers was the discussion forum. One teacher described using 'a fair number of discussion topics that may relate to the course material'. Such materials, he believed, helped 'the students stay engaged and motivated'.

Contexts in which SOT and AOT occur

In some contexts, teachers may be working in an essentially asynchronous context and may use SOT as a supplement, for example, when text-based communication has failed, as the following comment explains: 'Voice is usually kind of used if they've run into a wall. Or if it's something that I'm having difficulty explaining in words … but the majority of it is done in text'.

In other contexts, 'the synchronous component is not central to the instructional component of the course, but perhaps might be more in terms of support and communication, as opposed to direct instruction'. Some teachers may be working primarily in a learning management system that houses asynchronous communication tools such as a discussion forum and email. These systems may include as well links or access to content such as textbook chapters, videos or, in some instances, podcasts. The only synchronous tools provided by this system would be a text-based chat. SOT using chat might serve for real-time resolution of problems or answering questions, 'to work through a problem'. Problems may be addressed by using individual or group chat, as the following teacher explained: 'Sometimes there may only be one student that [sic] will come if they have a problem; sometimes I'll have 10, so it just varies on the day and what module they're working on and if they have questions or concerns.'

Communication by synchronous chat may not address the problem, in which case videoconferencing might be used: 'If a student was having a specific problem with an assignment, that is when I would use [videoconferencing] most.' In other contexts, teachers might rely on SOT for the purpose of 'keep[ing] the kids together … for the social aspect, just so they see that they're not alone in the distance education world, they do have opportunities to meet together synchronously', or in order to 'incorporate opportunities for students to interact'. A 'cafeteria' supervised by teachers might be created as a 'social chat' room for students 'to socialize'. Chat might be available for students to communicate socially during group instruction, but the teacher might decide to place restrictions on the use of this tool:

> When I'm delivering a lesson, they can't be chatting at the same time. I can take that ability away from them. I can say to them, … 'you've got 5 minutes to chat'—because they like to socialize with each other—'then I'm taking away your instant messaging.'

In a context of AOT, a teacher may also opt to use the telephone or Voice over Internet Protocol to 'work in real-time with students, answering their questions'. Teachers may use the phone to contact students if they 'suddenly drop off the radar and are not sending stuff in ...' or 'to track down students who have not been submitting regularly'. Teachers may also phone students' parents or the school to ensure that students submit assignments on time. The teacher might take the initiative to phone a student to provide one-on-one attention. One teacher explained when he makes use of this option: 'I have ... called the school if the student really doesn't understand a certain lesson. I will call the school when I know that they're available and I'll speak to them directly over the phone'.

Some contexts of DE were limited to AOT, since teachers had no access to a dedicated suite of synchronous tools such as Elluminate Live™ or Wimba™ software. In some contexts they may not have been even using an asynchronous learning management system with a discussion forum or synchronous chat. In these contexts, students might 'send their assignments in through email', and complete 'individual assignments per day'. Some contexts resembled early forms of correspondence teaching whereby 'the course material is sent out hard copy to the individuals concerned, who then have homework assignments to do, and then they would write an exam'.

Students' preference for AOT versus SOT

As one teacher observed, '...the kids prefer to chat and not talk on Skype'. Asynchronous communication may be the preferred form of communication for instruction because students prefer it. One teacher remarked: 'Very seldom would we use voice. Students will rarely request it. It's much easier, I find, to [use] text'. Similarly, another teacher noted: 'A lot of students really enjoy email because they can ask me two or three questions and I can take the time to flip through a few pages, rewrite stuff—that is the most common way for us to communicate for a specific question'.

Limitations of SOT

Teaching synchronously may not be possible in many contexts of DE, particularly in self-paced programmes in which students 'start and finish at any time' and do not move together throughout the course. Students may have timetables that 'are completely different'. In fact, in some cases, there is no guarantee that a particular student will be on a particular topic at a particular time. As one teacher observed, '...I have one student one assignment away from finishing and another student who just started 2 weeks ago, and they're all in the same course ... nobody's at the same spot'.

Discussion

The 42 teacher interviews revealed that AOT was more common than SOT. This finding is congruent with that of Barbour (2009), who noted that AOT is the preferred form of delivery in US virtual schools. In Canada, 'some provinces make extensive use of synchronous instruction, while others rely almost exclusively on asynchronous instruction' (p. 14). In the Canadian province of Newfoundland and Labrador, as much as 60% of instruction may be synchronous (Murphy & Rodríguez-Manzanares, 2008).

The time-independent AOT facilitates forms of learning whereby students can stop and start at different times and proceed at their own pace. These forms are self-paced, largely self-regulated and highly independent forms of learning. Working in groups or coming together at a specific time is not a requirement of this form of learning. We can assume, although the teachers did not discuss this aspect, that it might be suited to students schooled at home who are not bound by a school schedule. On the other hand, those students enrolled in a school might be more easily scheduled into a class period. Student-to-student interactivity in these self-paced forms of learning is minimal. Teacher-to-student interactivity may be limited to a phone call or an email when students have a problem or question.

In general, interactivity did not play a prominent role in teachers' descriptions of either AOT or SOT. Some descriptions of AOT using the discussion forum referenced students working and communicating together but these were the exception. The descriptions of SOT using audio and/or video suggested that it was for lectures or direct instruction by the teacher. Bernard *et al* (2004) argue, based on their meta-analysis of studies focused primarily on post-secondary education, that 'media appeared to be more important in synchronous DE than in asynchronous DE' (p. 401). However, our findings support the argument that it is not the media but the pedagogy that determines the interaction. As Clark (1983) argued, 'media are mere vehicles that deliver instruction but do not influence student achievement any more the truck that delivers our groceries causes changes in our nutrition' (p. 445). In spite of the fact that the SOT tools afforded interactivity, the teaching approaches did not afford it.

de Freitas and Neumann (2009) also emphasised the importance of pedagogy as opposed to media. They conducted a review of the literature on Synchronous Audiographic Conferencing, which they described as 'an opportunity for implementing and supporting effective pedagogic strategies … especially in non-standard contexts such as distance education' (p. 994). They also identified pedagogic strategy as 'central'. In a context of high school virtual schooling, Barbour's (2007) study revealed that teachers covered most of the course content during synchronous class time and made poor use of the scheduled asynchronous class time. His finding once again confirms the importance of pedagogy for both SOT and AOT. Similarly, Murphy and Coffin (2003) argued in favour of online synchronous activities that might support more student-centred forms of interaction. They suggested, for example, that synchronous collaboration tools such as the whiteboard could be used, not for the delivery of content, but as a support to student-to-student communication.

Bernard *et al* (2004) reference the need for 'deep' as opposed to 'surface' interaction. Providing students with opportunities to interrupt a lecture to ask a question would not constitute 'deep' interaction. In fact, we would argue that, if the only interaction that is supported or promoted is superficial or surface, then the lectures could be delivered asynchronously, ie, recorded live and then replayed by students at their convenience and at their own pace. Questions could then be submitted by email.

Conclusions

The study reported on in this paper was limited to the Canadian context. We do not know if our findings might have been similar had we included American high school DE teachers. However, in Canada, given that policies and practices related to education vary from province to province, situating the study in this context provided an opportunity to survey a range and variety of approaches. Our findings revealed considerable similarity in terms of a preference for AOT, for text and for DE classroom practices that do not typically take advantage of the interactive features of synchronous or asynchronous tools.

Given the limitations of our study, our implications must be considered within the context of a study of 42 Canadian teachers. Within that context, we would put forth the need for high school DE teachers to be well-grounded in pedagogy, particularly when using highly 'interactive' media. Professional development opportunities might focus on the types of 'deep' interactions that can and should be promoted in SOT. The costs in terms of time and money might be better spent elsewhere if SOT is simply used to deliver lectures that could be 'canned' or recorded and delivered asynchronously.

If DE high school students actually prefer text, then interactive television, videoconferencing and audio conferencing may prove ineffective even when teachers have the strategies to effectively use these media in more student-centred ways. The value of messaging for this age group may reflect,

not only a preference for text-based interactions, but a preference for asynchronicity. Such a preference might diminish the value of reliance on SOT in learning. Teachers referred to using voice largely when students appeared to be having problems. Thus, it may be that voice does have an important role to play at this age level in terms of connecting with students and retaining them in DE.

Acknowledgements

The study reported on in this paper was made possible by a grant from the Social Sciences and Humanities Research Council of Canada (SSHRC). Thank you to research assistant Kate Scarth for her assistance with coding and to Charlie O'Keefe and Janine Murphy for recruitment of research participants.

References

Abrami, P. C., Bernard, R. M., Wade, A., Schmid, R. F., Borokhovski, E., Tamin, R. *et al* (2007). A review of e-learning in Canada: a rough sketch of the evidence, gaps and promising directions. *Canadian Journal of Learning and Technology*, *33*, 1, 1–68.

Aviv, R. (2001). Educational performance of ALN via content analysis. *Journal of Asynchronous Learning Networks*, *4*, 2, 53–72.

Barbour, M. K. (2007). What are they doing and how are they doing it? Rural student experiences in virtual schooling. Unpublished doctoral dissertation, University of Georgia.

Barbour, M. K. (2009). Today's student and virtual schooling: the reality, the challenges, the promise. *Journal of Distance Learning*, *13*, 1, 5–25.

Barbour, P. & Stewart, R. (2008). *A snapshot state of the nation study: K-12 online learning in Canada*. Retrieved October 30, 2008, from http://www.nacol.org/docs/NACOL_CanadaStudy-lr.pdf.

Barker, K. & Wendel, T. (2001). *E-learning: studying Canada's virtual secondary schools*. Kelowna, BC: Society for the Advancement of Excellence in Education.

Bernard, R. M., Abram, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L. *et al* (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research*, *74*, 379–439.

Canadian Council on Learning (2009). *State of E-learning in Canada*. Ottawa: Canadian Council on Learning. Retrieved June 29, 2009, from http://www.ccl-cca.ca/pdfs/E-learning/E-Learning_Report_FINAL-E.PDF.

Cavanaugh, C., Barbour, M. & Clark, T. (2009). Research and practice in K-12 online learning: a review of open access literature. *The International Review of Research in Open and Distance Learning*, *10*, 1. Retrieved November 20, 2009, from http://www.irrodl.org/index.php/irrodl/article/viewFile/607/1183.

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research*, *53*, 4, 445–459.

DiPietro, M., Ferdig, R. E., Black, E. W. & Preston, M. (2008). Best practices in teaching K-12 online: lessons learned from Michigan Virtual School teachers. *Journal of Interactive Online Learning*, *7*, 1. Retrieved November 20, 2009, from http://www.ncolr.org/jiol/issues/PDF/7.1.2.pdf.

de Freitas, S. & Neumann, T. (2009). Pedagogic strategies supporting the use of Synchronous Audiographic Conferencing: a review of the literature. *British Journal of Educational Technology*, *40*, 6, 980–998.

Friend, B. & Johnston, S. (2005). Florida virtual school: a choice for all students. In Z. L. Berge & T. Clark (Eds), *Virtual schools: planning for success* (pp. 97–117). New York: Teachers College Press.

Haughey, M. (2002a). *Canadian research on information and communication technologies: a state of the field paper*. Paper presented at the 2002 Pan-Canadian Education Research Agenda Symposium. Retrieved October 17, 2008, from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.84.998&rep=rep1&type=pdf.

Haughey, M. (2002b). *Pan-Canadian research options: new information technologies and learning*. Retrieved October 17, 2008, from http://www.cesc.ca/pceradocs/1999/99Haughey_e.pdf.

Haughey, M. & Muirhead, W. (2004). Managing virtual schools: the Canadian experience. In C. Cavanaugh (Ed.), *Development and management of virtual schools: issues and trends* (pp. 50–67). Hershey, PA: Information Science Publishing.

Hrastinski, S. (2007). Participating in synchronous online education. Unpublished doctoral dissertation, Lund University, Germany. Retrieved March 13, 2009, from http://lup.lub.lu.se/luur/download?func=downloadFile&fileOId=600490.

Hrastinski, S. (2008). Asynchronous and synchronous e-learning. *EDUCAUSE Quarterly*, *31*, 4, 51–55.

Johnson, G. (2008). The relative learning benefits of synchronous and asynchronous text-based discussion. *British Journal of Educational Technology*, *39*, 1, 166–169.

Murphy, E. & Coffin, G. (2003). Synchronous communication in a web-based senior-high school course: maximizing affordances and minimizing constraints of the tools. *American Journal of Distance Education*, *17*, 4, 235–246.

Murphy, E. & Rodríguez-Manzanares, M. (2008). Revisiting Transactional Distance Theory in a context of web-based high-school distance education. *Journal of Distance Education*, *22*, 2, 1–14.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Powell, A. & Patrick, S. (2006). *An international perspective of K-12 online learning: a summary of the 2006 NACOL international e-learning survey*. Vienna, VA: North American Council for Online Learning. Retrieved November 20, 2009, from http://www.inacol.org/research/docs/InternationalSurveyResultsSummaries.pdf.

Roblyer, M. D., Freeman, J., Stabler, M. & Schneidmiller, J. (2007). *External evaluation of the Alabama ACCESS initiative: PHASE 3 report*. Eugene, OR: International Society for Technology in Education. Retrieved January 21, 2009, from http://accessdl.state.al.us/2006Evaluation.pdf.

Strauss, A. L. & Corbin, J. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Zucker, A. & Kozma, R. (2003). *The virtual high school: teaching generation V*. New York: Teachers College Press.