Computer-Assisted Instruction (CAI) in Language Arts: Investigating the Influence of Teacher Knowledge and Attitudes on the Learning Environment

Jamie M. Davis

University of Alberta

April 20, 2009

Table of Contents

Purpose of the Study

Throughout my life the ability to read has been a constant companion, but it was not until I began working with striving learners that I truly realized the numerous gifts this seemingly innocuous skill provides. Reading has provided me with an easily accessible form of respite, many colourful and cherished friends, an effortless way of acquiring new knowledge, in addition to a means of providing monetary wealth and security for myself and my family. Like many individuals who have experienced little or no barriers in acquiring literacy skills, I felt as though the ability to read proficiently was innate. However, my experiences in the classroom taught me that acquiring literacy skills is, at times, an unexplainably difficult undertaking for some students.

Although it might be convenient to assume that the battle to acquire literacy is centred on lack of student motivation, their resistance to learn, and the lack of parental support they receive, that was simply not the case in my classroom. In fact, despite my students' hard work, desire and commitment to learn, my knowledge of literacy acquisition, their parental support, and all of our best combined efforts literacy continued to elude many of them. Five years later I am still left wondering what will happen for the students who, despite their hard work and dedication make minimal gains in their literacy skills.

When I began working with *Scholastic Canada Ltd*, in the role of Library and Technology consultant, I discovered that my classroom experience was not isolated. In fact, struggles to acquire literacy continue to be the focus of my discussions with teachers and teacher librarians throughout Western Canada. At a National level, literacy acquisition concerns are reflected in the most recent Canadian literacy statistics derived from the results of the second

International Adult Literacy and Skills Survey (IALSS). The IALSS, performed in 2003 and released in November of 2005, studied over 23 000 Canadians assessing their abilities in four areas, including prose literacy, document literacy, numeracy and problem solving. Five broad categories were employed to express varying literacy skills ranging from five – the highest, to one the lowest. The results of this study indicated that approximately 972 000 Canadians possess level one literacy skills, and an additional 1.6 million Canadians possess level two literacy skills (Centre for Family Literacy, 2006).

Recent Canadian literacy results are increasingly disconcerting from both an educational and social perspective as the requirement for proficient literacy skills amplifies to accommodate the demand of Canada's knowledge-based economy - an economy directly related to knowledge stock and learning capabilities (Foray, & Lundvall, 1998). In educational settings, students with proficient literacy skills are more likely to complete high school (The Daily, 2006), and generally experience higher levels of academic success in all subject areas (Merisuo-Storm, 2006). Outside of education, individuals with proficient literacy skills experience a lower rate of unemployment, higher wages earned when working, and generally better health outcomes in the long term (Bowlby, 2005; Canadian Council on Learning, 2005; Centre for Family Literacy, 2006).

Because of the positive, long-term effects proficient literacy skills have on individuals, educators are looking for alternate teaching practices to help all learners acquire these skills. The integration of Computer-Assisted Instruction (CAI) in the Language Arts classroom can greatly assist teachers meet the needs of diverse literacy learners by providing the student with immediate feedback, differentiated and scaffolded learning activities, in a safe, private and risk-

friendly learning environment. Several landmark studies have indicated that including CAI in literacy learning yields positive results in reading ability, especially for striving readers (Balajthy, 2007; Grenawalt, 2004; Proctor, Dalton, & Grisham, 2007; Soe, Koki, & Chang, 2000; Tillman, 2004). When used purposefully, CAI can transform the learning environment (Balajthy, 2000; ChanLin, Hong, Horng, Chang, & Chu, 2006; Richardson Kemp, 2005).

However, this new technology does not come without some concerns, including but not limited to: ease of implementation, funding for new hardware and software, appropriate teacher support, efficacy of computer generated assessments, as well as the questionable positive effects CAI has on reading comprehension. Perhaps the most prohibitive concerns regarding implementing CAI centre on the individuals within the school community. An educator's knowledge of, attitudes towards, and competency with CAI will greatly influence the successful integration of it in the classroom (D'Silva, 2006; Green & Siegle, 2002; Judah, 1999; Reynolds, Treharne, & Tripp, 2003; Roschelle, Pea, Hoadley, Gordin, & Means, 2000; Zhao, & Cziko, 2001). Because of this well-documented dynamic, continued research on the issues surrounding teachers' use of CAI in the classroom is imperative. Additional research is especially important as new, innovative and increasingly sophisticated forms of CAI become available and as Alberta Education adopts a philosophy of infused technology in all curricular areas.

Research Intentions

Because teachers work to marry policy with praxis, they make choices that reject, tolerate, or embrace CAI. By speaking directly with classroom teachers about their experiences with CAI, I sought to gain insight into the complex logistics of successful implementation. Although accessing teacher insight might appear to be in contrast with the usual ways

governments, school districts and even schools choose to implement new technologies, directing my attention to the teachers' lived experience with CAI provided insight into the authentic advantages, limitations, successes and challenges. Although it was not the intent of my research, I hope that it may in some small way give voice to classroom teachers, whose wisdom is not always accessed during times of sweeping change. Additionally, I hope that my investigation addresses some of the need for additional research in the area of teacher influence over the successful integration of CAI.

Research Question and Sub-questions

My research will explore the following question:

What influence does teacher knowledge of, and attitudes towards, Computer-Assisted Instruction (CAI) have on its inclusion in the Language Arts classroom? To address my main research question, I will include the following sub-questions:

1. How do classroom teachers envision Computer-Assisted Instruction fitting into the language arts classroom, if at all?
2. Does the inclusion of Computer-Assisted Instruction improve the teaching experience of language arts teachers?
3. Do teachers feel that including Computer-Assisted Instruction improves the learning experience of their students?

Definition of Terms

Terms:

Computer-Assisted Instruction: For the purposes of this research, Computer-Assisted Instruction (CAI) will include both hardware and software components of technology including, but not limited to: reading software programs, Internet-based programs, SMART Boards, laptops, and desktop computers.

Reading Ability: For the purposes of this research, reading ability will refer to an individual's mastery of phonemic awareness, phonics, vocabulary, fluency, and comprehension.

Literature Review

The decline of reading comprehension skills and motivation to read is of great concern from both an educational and social perspective. New definitions of literacy coupled with new

technologies have the potential to dramatically change the classroom to better serve millennial learners. Further, the advent of Computer-Assisted Instruction (CAI) programs might provide teachers with an easier means of meeting the needs of diverse learners. However, because CAI has a varied history of success, it is important to gain insight into the knowledge of, and attitudes towards, CAI from classroom teachers.

The Reality of Literacy Skills in Canada

The quest to develop literate individuals has been pervasive throughout the history of education. Despite numerous educational theories and practices the necessary literacy skills to fully participate in Canada's increasingly knowledge-based economy eludes approximately 20% of high school graduates (Lee, 2002). Although students with higher levels of reading proficiency are more likely to complete high school, students with limited reading ability are more likely to drop out of high school. On average, students who drop out of high school perform more than one full reading proficiency level below their graduate counterparts. Moreover, even when gender, language of origin, parental level of education, socioeconomic status, residential location, as well as, academic and social engagement are accounted for, reading proficiency affects high school graduation (The Daily, 2006).

Reading proficiency is linked to academic success across all subject areas (Merisuo-Storm, 2006). Lack of academic success causes disengagement from learning and subsequently a further decline in reading skills. For approximately 10% of Canadian youth, the cycle of declining skills and disengagement leads to school drop out. As Canada's economy transitions to a knowledge-based economy, the outlook is increasingly bleak for individuals not completing high school. Over a span of 30 years, between 1971 and 2001, the need for "knowledge workers" almost doubled in Canada. In that same time, the introduction of technology caused a

decline in the availability of jobs for unskilled or semi-skilled workers (Canadian Council on Learning, 2005). Recent Canadian statistics reflect this trend, as individuals who do not complete high school experience significantly higher rates of unemployment as compared to individuals who have completed high school, 12.2% and 6.8% respectively (Bowlby, 2005; Canadian Council on Learning, 2005). Thus, the need to engage students in reading extends beyond the educational realm into society at large.

Digital Immigrants Teaching Digital Natives? Literacy and the Millennial Generation

Recent research has begun to investigate what has been termed the "millennial" generation, a generation encompassing individuals born between 1982 and 2003 (Nicoletti & Merriman, 2007). Millennials are a particularly unique generational cohort because they are the first generation in history to share similar traits across all cultures, societies, and nations (Government House, 2008). The ubiquitous nature of technology in the lives of millennials has led authors to term this generation as "Digital Natives," while referring to everyone born prior to 1982 as "Digital Immigrants" (Clifford, 2005; Naish, 2008; Nicoletti & Merriman, 2007).

In response to the demands of the knowledge-based economy and the millennial generation, the definition of literacy has shifted. This shift is in part because literacy is a product and process of a culture, (King & O'Brien, 2002) "understood in the contexts of social, cultural, political, economic and historical practices" (Lankshear, & Knobel, 2007, p.1). With the advancement of technology over the last twenty years, the gap between how teachers view literacy and process information and how students view literacy and process information seems to have grown exponentially. New definitions of literacy now encompass both reading the word and the world (Hagood, Stevens, & Reinking, 2002). The idea of a "global village" is a reality for millennial students in part because of the recent leap from industrialized society, to

information society (Sasseville, 2004). With new technologies, students have the ability to access information, people and places previously inaccessible, expanding the boundaries of the traditional classroom (Leander, 2007; Roschelle, et al., 2000).

New definitions of literacy are reflected in the increased expectation amongst students to use new technologies for educational purposes as reported by educators (Reid, 2002). Millennials view technology as a way of life, as a means of learning, and an extension of themselves, rather than simply a tool (Government House, 2008). In response, educators are looking for ways to fuse pedagogically sound practices with new technologies while still maintaining strong human relationships as the foundation of education (Reid, 2002). Publishers are also creating resources that assist teachers in meeting the needs of all learners through the infusion of CAI in the classroom. Although effectively including CAI has been a challenge for some teachers, the availability of technology in schools coupled with sufficient teacher support for implementing new technology programs can greatly assist learners in the language arts classroom (Richardson Kemp, 2005; Proctor, Dalton, & Grisham, 2007; Soe, Koki, & Chang, 2000; Tillman, 2004).

Computer Assisted Instruction and the Language Arts Classroom

Tillman (2004) asserted that several landmark studies indicated including CAI in literacy learning yields positive results in reading ability, especially for striving readers. The integration of technology in the classroom may be "one of the most important new educational frontiers for working with struggling readers and ELLs" (Proctor, Dalton, & Grisham, 2007, p.90). Some studies suggest positive results are, in part related to students' increased motivation to learn when technology is included in the curriculum (Roschelle, et al., 2000; Tillman, 2004). Others indicate that gains are experienced because CAI allows students to work more comfortably at their own pace and convenience, in addition to providing access to superior learning materials,

customized tutors, as well as, automated measures of progress (Soe, Koki, & Chang, 2000). When used appropriately, CAI can transform the learning environment (ChanLin, et al., 2006; Richardson Kemp, 2005) and has the potential to dramatically improve literacy skills for striving readers (Grenawalt, 2004; Proctor et al., 2007).

However, some researchers have questioned the validity of CAI as an instructional tool due to the limited number of studies conducted, as well as the varied research methodologies and methods used to research CAI in the classroom (D'Silva, 2006; Soe, Koki, Chang, 2000; Tillman, 2004). Although a body of research indicated positive results, research has also found no significant improvement in reading comprehension while utilizing CAI (Balajthy, 2000; Brooks, Miles, Torgerson, & Torgerson, 2006). D'Silva (2006) suggested that, because of the plethora of programs available with a wide range of features, it is difficult to make sweeping generalizations about the true impact of CAI. This lack of ability to make generalizations coupled with the disparity in the availability of hardware, software, and the way technology is used in the classroom, along with the varied implementation plans of technological initiatives further contributes to mixed results (Roschelle, et al., 2000).

Nonetheless, the increased availability of computers in the classroom and home, in conjunction with the growing influence of an 'infused technology' philosophy necessitates that educators begin to make decisions about the use and benefits of CAI in the classroom (ChanLin et al., 2006). Many schools face roadblocks to the inclusion of CAI. Funding remains a struggle in schools becuase CAI is a costly venture. Purchasing new and relevant software, in addition to the hardware to support it is of significant cost. Further, a technical support person who can maintain and update both software and hardware is necessary for seamless inclusion in the classroom (ChanLin et al., 2006; Balajthy, 2007; D'Silva, 2006).

Still, perhaps the most prohibitive obstacles to implementing CAI centre on the classroom teacher. First, the availability and cost of professional development for educators is of great concern. Although initial professional development is important, several authors have discovered the positive effects for sustaining and increasing the use of CAI through collaborative coaching/mentorship relationships (Abbott, Greenwood, Buzhardt, & Tapia, 2006; ChanLin et al., 2006; Reid, 2002; Reynolds, Treharne, & Tripp, 2003; Roschelle, et al., 2000; Sasseville, 2004). Often the largest obstacle for a teacher utilizing CAI in the classroom is either the lack of knowledge of teacher training available or the absence of teacher training (Balajthy, 2007; ChanLin et al., 2006; D'Silva, 2006; Yildirim, 2000). Second, an educator's attitudes towards the validity of CAI and his/her personal teaching philosophy can significantly influence the integration of instructional software (ChanLin et al., 2006; D'Silva, 2006).

Last, the teacher's purposeful use of CAI, or lack thereof, can impact how, when and if CAI is included in instruction. For example, a study conducted at a university summer reading clinic revealed that in general Computer-Assisted instructional time was much less directed as compared to regular instructional time. Three trends emerged from the analysis (1) lack of teacher planning for activities that used CAI, (2) using CAI simply for the experience of using computers for literacy, and (3) using CAI for motivational purposes only (Balajthy, 2000).

Because the research design of this study only included observations and clinician questionnaires, it is difficult to know the reasoning behind the lack of planning for CAI. The non-directive CAI instructional decisions may reflect a lack of training, unfamiliarity with the increasingly sophisticated design of programs, or lack of knowledge regarding most effective ways to facilitate learning via CAI in their reading program. Alternately, the non-directive instructional use of CAI may suggest that negative attitudes towards this instructional tool, and

its efficacy for improving learning influenced the way it was integrated into the summer reading program.

Many times it is difficult to know why and how teachers make instructional decisions. This lack of insight is compounded by the limited research available that explores the teacher's lived experience of CAI in the classroom. A better understanding of how and why CAI is included or excluded in the classroom, how teachers utilize CAI, if CAI is perceived as an effective tool in the language arts classroom, as well as what supports are needed to facilitate the inclusion of this technology can be gained from further investigation into the experiences of classroom teachers.

Method

Because I wanted my research to provide insight into the lived experiences of classroom teachers, I employed a phenomenological research approach. The underlying foundation of the phenomenological approach is the notion of multiple, socially-constructed realities. Researchers utilizing this methodology seek to "understand the meaning of events and interactions to ordinary people in particular situations" (Mertens, 2005, p.23). Because an individual's perception of personal knowledge and understanding is central to this methodology, the results generated from phenomenological research are almost always qualitative in nature and cannot be generalized (Creswell, 2005; Davies & MacMillan, 2007; Mertens, 2005).

Because my intent was not to garner information that could be generalized, I employed a qualitative research design. As Patton (2002) suggested, I wanted to report data that was plausible given the specific context of data collection. I believe a phenomenological approach and design leant itself well to clarifying, understanding and communicating the lived experiences of teachers, especially given the context sensitive interactions in their diverse classrooms.

To allow for a deeper analysis of the rich data generated from qualitative research, I chose to limit the number of participants to six. In this study, six language arts teachers from four schools within a rural school division participated in one-to-one interviews. Participants were working in very diverse teaching assignments, and incorporated CAI into their language arts classrooms to varying degrees. Sarah and Lincoln taught grades 3 and 5 respectively in mainstream elementary settings (pseudonyms are used for all participants). Joshua taught in a grade 4 French Immersion setting, while also working as the school's Vice Principal. In addition to filling in for a maternity leave in high school English Language Arts, Louisa taught grade 9 language arts. Joyce worked as the special education facilitator at her school for students in grades 1 to 6. Finally, John worked with high school students teaching English Language Arts half time while coordinating the division's one to one laptop project half time.

The participants' years of teaching experience ranged from 8 to 30. However, five of the six teachers interviewed were experienced classroom teachers with between 17 and 30 years of experience. It is interesting that all the teachers taught in this rural school division from the start of their careers. Located roughly 45 minutes outside of a major center, this school division serves approximately 6,700 ECS to grade 12 students in 35 schools spanning a large geographic area of Alberta. The superintendent, administrators and teaching staff contacted were open to research, welcomed it in their division, and were extremely helpful in recruiting other participants. Because of their willingness to help, and my lack of experience with the division, most participants were recruited via a snowball sampling method, a form of purposeful sampling where the researcher asks participants to recommend other individuals for the study (Creswell, 2005).

During the months of November and December 2008 I conducted and audio-recorded one-to-one, semi-structured interviews with each teacher at locations of their choosing. Interview questions were derived from the themes that emerged in the literature discussing CAI in educational settings. Interviews ranged from 11 minutes to 70 minutes in length. After personally transcribing all interviews, transcripts were sent to participants for verification. Sample interview questions are included in the appendix.

During the data analysis process I read the transcripts multiple times in an effort to generate a listing of themes between the transcripts. All transcripts were colour coded to ensure that each participant could be easily identified during the process of analysis. Once themes were generated, corresponding codes were assigned to each and printed transcripts were labelled accordingly. Analysis shifted to an electronic format once the themes were identified and relevant comments were gathered. I created a list of colour coded comments relevant to each theme, and used this electronic document to determine the key findings of the research project.

Research Findings

The data comprised of six one-to-one audiotaped interviews. The interviews generated over 45 single spaced pages of data, providing insight into the classroom experience of CAI. To frame the findings, I briefly summarize interviewee definitions of CAI and familiarity with CAI resources. This framing is followed by a summary of the four themes that emerged: advantages and successes of CAI for students and teachers, limitations and challenges of CAI for students and teachers, teacher purpose and motivation for including CAI in language arts, and supports received and supports suggested for teachers implementing CAI.

Definitions and Familiarity

Although some interviewees seemed surprised by this interview question, all were able to verbalise their definition of CAI. With the exception of John, all interviewees defined CAI as using technology or the computer to help enhance student learning. Although John spoke about enhancing student learning with CAI throughout his interview, he defined CAI as a collaborative process between teacher and student which encouraged the classroom teacher to step aside from a didactic role, allowing student imagination, curiosity and creativity to drive instruction.

When asked about familiar CAI software, interviewees provided a variety of responses. However, all interviewees mentioned Microsoft Office programs like *Word, Excel* and *PowerPoint*. Other software programs like *Reader Rabbit, WiggleWorks, Dragon Naturally Speaking, Earobic,* and *Read & Write Gold* were also highlighted as familiar resources. While some interviewees discussed the Internet as a resource in general, others cited specific examples of Internet applications such as *Moodle, Gaggle, Zulupad, Gimp, Wikis* and *Raz Talking* that they included in their language arts instruction. Finally, some interviewees expanded their responses beyond classroom software, mentioning hardware like digital recorders, reading pens, *AlphaSmart* Keyboards and *SMART* Boards.

Advantages and Successes of CAI for Students and Teachers

All the teachers interviewed felt the advantages of including CAI in the language arts classroom were a higher level of student engagement, active participation by the students, and the ability to better meet the needs of their students. Three teachers interviewed stated that including CAI made the learning experience more fun for the student. In addition to increased

engagement and enjoyment, Louisa maintained that her students were less likely to “zone out” during the lesson. Joyce spoke about how including CAI in an animal research project fostered “deeper” learning for her students. She felt their “deeper” learning was evident by their ability to recall specific details about their selected animal almost a year later.

Besides student engagement, John and Louisa both discussed how CAI “levelled the playing field” for students within the school because of the equal access to technologies. As a result of this “levelling,” they noticed that their students were slowly becoming risk takers in their learning. In their classrooms, risk-taking was especially evident in what they described as the “middle of the road” or “average” students.

The majority of the teachers interviewed discussed the infiltration of technology in society, and the technological age students are growing up in as one of the advantages to including CAI in the classroom. Some teachers described students as having a “natural appetite” for technology, while others talked about students’ being “wired” for technology. These statements echoed the need for classrooms to remain current and reflective of the larger society, a society where boundaries and access to information have significantly expanded in the last two decades with the advent of the Internet. Related to the notion of a larger society, several of the teachers interviewed spoke about how CAI could “expand the limits of the traditional classroom” and allow their students to branch out and learn about other people, places and ideas. Louisa felt exploring different people and ideas was particularly important because she was working in a small rural community.

Many teachers felt that the increased student engagement was not only an advantage to the students, but also an advantage to the teacher. Joyce stated that there was a sense of calm in

her classroom when including CAI and the class subsequently ran smoother. However, although several teachers discussed how CAI saved time in class, they also cited the increased teacher preparation time. I elaborate on this point further in the limitations and challenges section of the findings. One of the most inspiring teacher advantages of including CAI was described by John who said, “It has made me a better teacher, it’s the possibilities ... you know what technology has done, it’s made me a learner again too ... it has made me a much better teacher I think.”

Limitations and Challenges of CAI for Students and Teachers

The interviewees discussed very few limitations of CAI for students. Lack of student experience with computers, and lack of skills to complete certain tasks with complex software programs were two limitations identified by Sarah and Joshua respectively. John discussed the reliance that students can develop on software, and the perception that the software will make the project better as a particular challenge when implementing CAI in the classroom. He also identified the increased level of frustration he observed amongst his students when any form of CAI did not work. He felt that because of the proliferation of the Internet, cell phones, and PDAs his students’ patience level had been significantly decreased, and he described them as “information junkies.”

Many limitations and challenges of CAI the interviewees highlighted centered on the teacher and school facilities. For many of the teachers, access to computer hardware and software, upkeep of existing hardware and software, software outdating and general maintenance issues were amongst the biggest challenges to implementing CAI in their classrooms. Joshua, who worked in a French immersion program, discussed the difficulty of finding appropriate French software programs. The lack of time available to learn how to use new technologies to their

fullest capacities and increased preparation time for classes infusing CAI were cited by the majority of teachers interviewed. John also cited “conventional wisdom” about CAI from other educators; the notion that the teacher will be replaced, that students will not learn anything, that CAI will make it easy for students and that CAI gives the student the answers as real challenges he faces while continuing to implement CAI in his role with the one-to-one project.

In light of the pre-reading of the literature in this area, I was surprised that only two of six teachers highlighted financial or monetary challenges when implementing CAI. I was equally surprised that only one of six teachers discussed previously negative experiences with CAI as a challenge to implementing it in the classroom.

Teacher Purpose and Motivation for Including CAI in Language Arts

All the teachers interviewed chose to include CAI in their language arts lessons in an effort to meet the needs of their students. However, although they shared a common purpose for including CAI, the teachers interviewed described how students’ needs were met through CAI in a variety of ways. Sarah and Lincoln included CAI when they had access to the computer lab because they wanted to improve their students’ skills. Joshua indicated that he used CAI to provide his students with opportunities to complete activities in “different modes.” Joyce and Joshua both discussed the need to integrate technology into the learner outcomes as mandated by *Alberta Education*. Joyce also highlighted how CAI increased the independent skills of her special needs students. Although Louisa described herself as someone who “liked technology but” was not “100% sold on technology,” she chose to include it in her language arts classroom because she wanted her students to feel successful and proud of what they could accomplish. She believed that including CAI in her language arts lessons gave her students a “chance to be

excellent." John was using CAI not only to tap into his students' creativity, but also to model lifelong learning for his students.

When asked about their personal motivation to include CAI in their language arts classrooms, half the teachers interviewed described themselves as being a 'techie,' or someone who has always been interested in technology. These interviewees described themselves as teachers who have sought out new technologies to include in their classrooms for the majority of their teaching careers. Further, they were often the support system for other teachers who wanted to use technology in their classrooms in the school or division.

Support Received and Supports Suggested for Teachers Implementing CAI

Overwhelmingly, all teachers interviewed talked about the importance of supports from fellow educators in the school or division. In fact, five of the six teachers interviewed learned about various forms of CAI from colleagues, the division special education coordinator, or a contact from an educational organization. Whether it was the nature of the topic or a sign of the societal shift in information gathering, all teachers interviewed talked about searching the Internet for resources to integrate into their lessons. The process of searching was described as a trial and error process of searching and subsequent self-teaching/learning of resources found.

About half the teachers interviewed talked about division-led professional development provided several years ago to teach teachers basic computer skills like working with *Word* and *PowerPoint*. John spoke about recent division-led professional development he received referred to as "at the elbow professional development." He described this as a form of professional development that provides teachers with ongoing, consistent and pertinent support from the

division. In his role as the one-to-one lead teacher, John also had access to professional development outside of the division that was relevant to his project. Some interviewees also spoke about professional development opportunities available through local organizations like Edmonton Regional Education Consultant Services (ERECS) and Central Alberta Regional Consortium (CARC).

Many supports that teachers received when implementing CAI in their classrooms were also supports they suggested for teachers who were interested in implementing CAI. A strong support system comprised of colleagues and division personnel was discussed as a necessity to successfully implementing CAI. However, interviewees made recommendations for team-teaching opportunities, mentorship and peer support relationships. Specifically, they recommended pairing a teacher who had experienced the "ups and downs" of implementing CAI in their classroom with a teacher just beginning the process. Although many teachers recognized that team-teaching and mentorship could be difficult to manage with limited time and school resources, they felt it was essential to successful implementation.

Several teachers spoke about developing a mindset, an openness to experiment and try new things as important qualities to embrace when first implementing CAI. Joshua recommended starting small, and gradually increasing CAI in lessons. John spoke about having a comprehensive understanding of the content area before trying to add in another dimension like CAI to the teaching/learning environment. Several teachers spoke about the need to be open to failure, to lose the fear of computers, to make time to learn and read relevant research. Devoting oneself to the process and being passionate about implementing CAI in the classroom were also suggested. On an optimistic note, John stated that devotion and passion are qualities frequently

found in teachers. I agree with this statement based on my experiences with the teachers interviewed.

Research Discussion

This project illustrated how diverse classroom teachers are in their inclusion of CAI in language arts. However, despite the diversity in classroom use, three important areas of consensus emerged amongst the teachers interviewed. These areas include the need for and value of including CAI for students, the challenges of accessing computer hardware, and the need for teacher time and mentorship.

The Need for and Value of Including CAI for Students

Amongst the teachers interviewed there was a general consensus about the need for and value of including CAI for student learning. Similarly, over recent years educators have reported positive feelings towards CAI in the literature (ChanLin, et al., 2006; Farnsworth, Shaha, Bahr, Lewis, & Benson, 2002;Reid, 2002; Reynolds, Treharne, & Tripp, 2003; Yildirim, 2000). However, despite their positive feelings the frequency and way in which the teachers in this project described the use and inclusion of CAI varied greatly. ChanLin, et al.'s (2006) study of eight creative teaching award winners discovered that although most of the teachers had positive feelings about CAI, there were mixed feelings about how to include it in creative teaching practices. The disparity of CAI inclusion can be explained in part because teachers are still in the process of discovering how to best use new technologies to foster teaching and learning. As such, CAI is not yet a fully integrated tool in the craft of teaching (Sasseville, 2004).

Certainly the process of including CAI into teaching practice has been a slow evolution. Although many educators view computers as new technology, in reality computers have been in schools for more than twenty years (Clifford, 2005). Yet the perception of newness and the slow pace of inclusion may be rooted in the ever-evolving nature of technology itself. Moore's Law states that approximately every eighteen months computers will double in speed and halve in price (Worzel, 2007). The constant state of flux Moore's Law describes makes it difficult for many educators to sense what technologies are available, and provides little time to make decisions around how to include these new computers to support student learning. This dilemma is not likely to change within the near future. For many teachers in this project, the process of learning to include CAI into daily instruction was plagued by the lack of access to CAI, the lack of experience with CAI, and the lack of time to work with CAI, rather than negative opinions about CAI's efficacy.

The Challenges of Accessing Computer Hardware

Just as the student acquiring literacy skills requires daily practise with engaging literature, the classroom teacher learning to use CAI requires regular practice with relevant, engaging forms of CAI. Regular practise necessitates that teachers and students have easy access to CAI in their classrooms. Almost all the teachers interviewed, with the exception of John the one-to-one lead teacher, talked about the challenges of gaining access to computer hardware. These interviewees worked in schools that maintained a computer lab model of access, and many teachers spoke about the difficulty they experienced gaining access to the school computer lab(s).

Often, lack of access increases frustration with and resistance to including CAI in classroom teaching (ChanLin et al., 2006; Reynolds, Treharne, & Tripp, 2003). As such, access issues will frequently have a negative affect on the likelihood of CAI inclusion, teacher and student confidence with CAI and the effective use of CAI in the classroom. Further, if gaining access to computer hardware is inconvenient for teachers they many times will opt to use other more traditional methods of teaching (Reynolds, Treharne, & Tripp, 2003).

Research purports that the effective use of technology in the classroom depends on infusing technology in all subject areas. Infusing technology throughout subject areas fosters a mentality of 'learning with technology' instead of 'learning about technology.' (Government House, 2008; Reynolds, Treharne, & Tripp, 2003). However, infusion necessitates flexible access to computers for both students and teachers. Reynolds, Treharne, and Tripp (2003) highlight a number of ways to ensure computer access for all members of a school including individual workstations in every classroom, clusters of computers distributed throughout the school, and/or laptop carts for departments to share. However, because of the significant cost of technical support, as well as computer software and hardware any changes to access will require monetary funding for schools.

Alberta Education's recent *Innovative Classrooms* funding allocates $18.5 million each year for three years in an effort to support further integration of technologies into classrooms. This funding is a wonderful start to providing the necessary monetary support to help resolve some of the access issues previously highlighted. Although only two of the teachers interviewed spoke about lack of monetary resources available for hardware, several teachers alluded to lack of funding while discussing their limited access to the computer lab, or struggle to keep hardware

in good working condition. If schools want to be responsive to new innovations and include them in the learning environment, access and funding will continue to be a concern. Further provincial funding, with established timelines similar to Alberta Education's recent initiative will likely be necessary.

Teacher Time and Mentorship

For the most part, all the teachers interviewed discussed the increased amount of time including new technologies required of the classroom teacher. In addition to learning about new technologies, interviewees noted that there were a number of additional time consuming demands outside of classroom instruction placed upon teachers like coaching, drama clubs, and report cards. Lack of CAI inclusion is perhaps less about fear and negative feelings and more about how many other time and energy draining activities are already a part of the classroom teacher's role (Curwood, 2008). Only one teacher interviewed was allocated time within the working day to learn about and work with new technologies. Although numerous studies discuss the benefits that teacher training, confidence and access to CAI have on inclusion in the classroom, (Abbott, et al., 2006; ChanLin, et al., 2006; Reid, 2002; Reynolds, Treharne, & Tripp, 2003; Roschelle, et al., 2000; Sasseville, 2004) providing the time and tools remains a struggle.

However, simply providing the hardware and teacher time is not enough to ensure engaging, collaborative, and effective inclusion of CAI in the classroom. "It seems that training for teachers and a whole school ICT development policy have a symbiotic relationship – the existence of one of these factors tends to be the vehicle for the other to make progress. But the absence of both, very little progress is made" (Reynolds, Treharne, & Tripp, 2003, p. 164). Rather than a traditional model of one-time professional development, the rapidly changing face

of new technologies lends itself more to a mentorship model of professional development (PD). Although many teachers interviewed talked about the need for and benefits of this type of PD, only a few had experienced informal versions of mentorship PD for implementing CAI in classroom practise. Further, interviewees were cautious to recommend this form of PD because they recognized that it is costly and many schools do not have the necessary funding to support this model of implementation.

In the research on the topic of supporting CAI in the classroom, mentorship models of professional development are evident. This model of PD not only allows for the necessary reflective praxis and collaboration amongst colleagues that new technologies demand, but also allows teachers to receive support specific to their needs. Mentorship fosters comfort and experimentation with new technologies in the classroom, and helps to sustain the infusion of CAI (Abbott, et al., 2006; ChanLin, et al., 2006; Curwood, 2008; Potvin & Dionne, 2007; Reid, 2002).

Although it is important for schools to receive funding for new hardware and software to maintain and improve technologies in schools, it is equally important that governments and school divisions invest in teacher development. Studies have demonstrated that teacher knowledge and confidence with new technologies translate directly into student learning because the teacher's ability to assist student learning is largely dependent on their personal level of mastery (Roschelle, et al., 2000). All future technology funding initiatives should take this into account and allocate a portion of the funds specifically to teacher development time including mentorship models of professional development.

What's Next for CAI in Education?

As a former teacher now working with an educational publishing company, the findings made it apparent that publishers need to be aware of the needs and expectations of both students and teachers while creating new resources that utilize CAI. Meeting the needs of increasingly technologically savvy “Digital Natives,” while providing user-friendly and pedagogically sound resources for the likely “Digital Immigrant” classroom teacher, will become increasingly important. This balancing act will require input from both educators and students throughout the creation of new resources. While teachers can provide insight into the pedagogy of new resources, students can help to guide the creation of resources that infuse new innovative and relevant technologies.

Further, as more programs become available through shareware, license free or for minimal charge, it will be imperative that educational publishers add in value to their ‘for purchase’ resources. The most obvious way to add value is by including technical support, as well as, initial and ongoing teacher training with the purchase of CAI programs. With growing awareness and comfort with webinars, teleconferencing, and other social networking applications, I believe ongoing teacher support can become a cost-effective reality for communities of teachers who have not previously had access to this kind of professional development because of their remote location or the size of their school population.

I would further suggest that with the advent of web 2.0 applications, mentorship relationships need not be limited to the school building or district. Developing a mentorship relationship with an individual because they are a good fit, rather than because they are in the same building is a now a reality for teachers. “By networking with mentors and other teachers electronically, teachers can overcome the isolation of the classroom, share insights and

resources, support one another's efforts and engage in collaborative projects with similarly motivated teachers" (Roschelle, et al., 2000. p.92) Teachers need only ask their students how easily relationships can develop with people from around the world with the use of new Internet applications. Because such mentorship relationships will be relatively new to teachers, the logistics will need to be explored further.

Last, I believe that classroom teachers need to form collaborative relationships with their students. Regardless of the number of hours in professional development, the keenness of the individual, or the time available to practise, a "Digital Immigrant" will never entirely become a "Digital Native" (Clifford, 2005; Naish, 2008; Nicoletti & Merriman, 2007). However, an interactive learning community between teacher and student is possible. While students can model for teachers how to best utilize forms of CAI, teachers can help mould these applications into pedagogically relevant endeavours. This moulding will require a role reversal of sorts where teachers move away from the role of "knower" or "sage on the stage" to one of collaborative co-learner with students (King, & O'Brien, 2002; Reid, 2002). A collaborative philosophy not only shifts the classroom from the traditional teacher-centered to student-centered (Zhao & Cziko, 2001), but also shifts the school's focus from maintaining to improving.

Although the CAI literature sometimes notes teachers' apprehension about teaching students with more knowledge and understanding of new technologies, others embraced the co-learner model with success (Hagood, Stevens, & Reinking, 2002; Zhao & Cziko, 2001). Again, research of the teacher student collaborative learning of new technologies is required.

Conclusion

The disparity in teacher skills, understanding, inclusion and access to CAI has been evident throughout this research project, and within the literature on the topic. Although there is no one way of implementing CAI in the language arts classroom that will ensure success for all students and teachers, teachers at all skill levels are open to learning more about how to effectively include CAI in their classrooms. Despite the numerous challenges teachers experience with lack of time, training, equipment and the increased demands for extra curricular involvement, there remains for most teachers a general willingness to learn about new technologies.

Additionally, a consensus that CAI must be infused throughout all subject areas in order to meet the needs of millennial learners emerged. There is a strong sense among classroom teachers that millennial learners exhibit unique traits and expectations for their learning environment that schools are just beginning to realize and respond to. There is also a consensus about how best to facilitate this for classroom teachers. By accessing teacher wisdom, the findings of this project suggest regular access to hardware and software, time to experiment with and learn about new technologies, and access to professional development via a collaborative coaching/mentorship model must be made available to classroom teachers throughout the processes of implementation and maintenance. The collaborative coaching/mentorship form of professional development is certainly supported by the literature on the topic of successful implementation of CAI.

I am in schools daily conferencing with teachers who are implementing new technologies to varying degrees in my role with *Scholastic Canada Ltd.* This research project has verified my belief that publishers of educational software are in a position to assist in changing the face of

education not only by providing superior learning resources, but also by supporting schools with the professional development necessary for successful implementation of new technologies. I am excited to be a part of this process in my own territory and have already witnessed the positive effects a partnership between a school and publisher can have for the classroom teacher and students.

References

Abbott, M., Greenwood, C., Buzhardt, J., & Tapia, Y. (2006). Using technology-based teacher support tools to scale up the classwide peer tutoring program. *Reading and Writing Quarterly, 22,* 47-64. Retrieved July 5, 2008, from CBCA Education database.

Balajthy, E. (2000). Isues in technology: The effects of teacher purpose on achievement gains. *Reading and Writing Quarterly,16,* 289-294. Retrieved July 5, 2008, from EBSCOhost Education database.

Balajthy, E. (2007). Technology and current reading/literacy assessment strategies. *The Reading Teacher, 61*(3), 240-247. Retrieved July 5, 2008, from ProQuest Education Journals.

Bowlby, G. (2005). Provincial drop-out rates- Trends and consequences. Retrieved May 12, 2008, from http://www.statcan.ca/english/freepub/81-004-XIE/2005004/drop.htm

Brooks, G., Miles, J.N.V., Torgerson, C.J., Torgerson, D.J. (2006, June). Is an interventions using computer software effective in literacy learning? A randomised controlled trial. *Educational Studies 32*(2), 133-143. Retrieved June 18, 2008, from Informaworld.

Canadian Council on Learning. (2005). Good news: Canada's high school dropout rates are falling. Retrieved May 12, 2008, from

http://www.ccl-cca.ca/CCL/Reports/LessonsInLearning/LiL-16Dec2005.htm

Centre for Family Literacy. (2006). *International Adult Literacy and Skills Survey.* Retrieved August 6, 2006, from http://www.famlit.ca/

ChanLin, L., Chao, J., Horng, J., Chang, S., & Chu, H. (2006, February). Factors influencing technology integration in teaching: A Taiwanese perspective. *Innovations in Education and Teaching International, 43*(1), 57-68. Retrieved July 5, 2008, from ProQuest Education Journals.

Clifford, P. (2005). CYBER kids. *Education Canada, 45*(2), 14-16. Retrieved September 12, 2008, from CBCA Education database.

Creswell, J. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research (2nd ed.).* Upper Saddle River: Pearson.

Curwood, J.S. (2008, August). Generation IM: Getting through to today's teched-out children. *Instructor,* 34-37. Retrieved September 12, 2008, from CBCA Education database.

Davies, M. & MacMillan, P. (2007). *Doing a successful research project: Using qualitative or quantitative methods.* New York: Houndmills, Basingstoke, Hampshire.

D'Silva, R. (2006). Reading by bits and bytes: The use of computer reading software in classrooms. English Quarterly, 38(4). Retrieved June 6, 2008 from CBCA Education database.

Farnsworth, B.J., Shaha, S. H., Bahr, D.L., Lewis, V.K., & Benson, L.F. (2002). Preparing tomorrow's teachers to use technology: Learning and attitudinal impacts on elementary students. *Journal of Instructional Psychology, 29*(3), 121-138. Retrieved July 15, 2008, from EBSCOhost Education database.

Foray, D. & Lundvall, B. (1998). The knowledge-based economy: From the economies of knowledge to the learning economy. In D. Neef, G.A. Siesfeld, J. Cefola (Eds.), The Economic Impact of knowledge (pp. 115-122). Oxford: Butterworth-Heinemann.

Government House. (2008). *Discussion paper: Environmental scan issues and drivers discussion*. Retrieved December 17, 2008 from http://education.alberta.ca/media/821494/escandiscussionpaper.doc

Green, C., & Siegle, D. (2002, April). The impact of SES and teacher exposure to technology on student achievement gain scores. Retrieved May 26, 2008, from http://www.gifted.uconn.edu/siegle/Conferences/GreenSieglePaper.pdf

Grenawalt, V. (2004, December). Going beyond the debate: Using technology and instruction a balanced reading program. *Teacher Librarian, 32*(2), 12-15. Retrieved May 26, 2008 from CBCA Education database.

Hagood, M., Stevens, L., Reinking, D. (2002). What do they have to teach us? Talkin' 'cross generations! In D. E. Alvermann (Ed.), *Adolescents and literacies in a digital world* (pp.68-83). New York: Peter Lang Publishing Inc.

Judah, M. (1999). Technology integration: Ready or not, here it comes. *ATA Magazine, 80*(1), 17-20. Retrieved December 5, 2008, from CBCA Education database.

King, J., & O'Brien, D. (2002). Adolescents' multiliteracies and their teachers' needs to know: Toward a digital detente. In D. E. Alvermann (Ed.), *Adolescents and literacies in a digital world* (pp.40-50). New York: Peter Lang Publishing Inc.

Lankshear, C. & Knobel, M. (2007).Sampling “the new” in new literacies. In M. Knobel, & C. Lankshear (Eds.), *New literacies sampler* (pp.1-24). New York: Peter Lang Publishing Inc.

Leander, K. (2007). “You won’t be needing your laptops today”: Wired bodies in the wireless classroom. In M. Knobel, & C. Lankshear (Eds.), *New literacies sampler* (pp.25-48). New York: Peter Lang Publishing Inc.

Lee, E.A. (2002). Adolescent literacy: Current status. *English Quarterly, 34*(3/4). Retrieved May 12, 2008 from CBCA Education database.

Merisuo-Storm, T. (2006). Girls and boys like to read and write different texts. Scandinavian Journal of Educational Research, *50*(2), 111-125. Retrieved February 3, 2007, from Metapress Routledge Education database.

Mertens, D. (2005). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods (2nd ed.).* Thousand Oaks: Sage.

Naish, R. (2008 June). The digital ages of man. e*learning Age,* 10-11. Retrieved September 12, 2008, from ABI/INFORM Global.

Nicoletti, A. & Merriman, W. (2007). Teaching millennial generation students. *Momentum, 38*(2), 28-31. Retrieved September 12, 2008, from ProQuest Education Journals.

Patton, M. (2002). Qualitative research and evaluation methods. Thousand Oaks: Sage

Potvin, P., & Dionne, E. (2007). Realities and challenges of educational reform in the province of Quebec: Exploratory research on teaching science and technology. *McGill Journal of*

Education, 42(3), 393-410. Retrieved November 12, 2008, from CBCA Education database.

Reid, S. (2002). The integration of information and communication technology into classroom teaching. *Alberta Journal of Educational Research, 48*(1), 30-46. Retrieved December 5, 2008, from ProQuest Education Journals.

Reynolds, D., Treharne, D., & Tripp, H. (2003). ICT-the hopes and the reality. *British Journal of Educational Technology, 34(*2), 151-167. Retrieved September 21, 2008, from EBSCOhost Education database.

Richardson Kemp, C. (2005). Comprehensive approach to adolescent literacy. *Principal Leadership, 5*(6), 22-27. Retrieved July 5, 2008, from ProQuest Education Journals.

Roschelle, J., Pea, R., Hoadley, C., Gordin, D., & Means, B. (2000). Changing how and what children learn in school with computer-based technologies. *The Future of Children and Computer Technology, 10*(2), 76-101. Retrieved September 12, 2008, from the Directory of Open Access Journals.

Sasseville, B. (2004). Integrating information and communication technology in the classroom: A comparative discourse analysis. *Canadian Journal of Learning and Technology, 30*(2). Retrieved September 13, 2008, from Directory of Open Access Journals.

Soe, K., Koki, S., Chang, M. (2000). Effect of computer-assisted instruction(CAI) on reading achievement: A meta-analysis. Retrieved June 7, 2008 from http://www.org/products/Products/effect-cai.htm

The Daily, Wednesday, June 7, 2006. *Statistics Canada.* Retrieved June 8, 2006 from http://www.statcan.ca/Daily/English/060607/d060607a.htm

Tillman, P., (2004). Computer-assisted instruction (CAI) and reading acquisition: A synthesis of the literature. Retrieved June 6, 2008 from teach.valdosta.edu/are/TillmanPLRFinal.pdf

Worzel, R. (2007, Nov/Dec). Tomorrow's mind. *Teach*, 5-6. Retrieved September 12, 2008 from CBCA Education database.

Yildirim, S. (2000, Summer). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education, 32*(4), 479-495. Retrieved July 8, 2008, From EBSCOhost.

Zhao, Y., & Cziko, G. (2001). Teacher adoption of technology: A perceptual control theory perspective. *Journal of Technology and Teacher Education*, *9*(1), 5-30. Retrieved September 12, 2008, from Wilson Web database.

Interview Questions

Computer-Assisted Instruction (CAI) in Language Arts: Investigating the Influence of Teacher Knowledge and Attitudes on the Learning Environment

*Please note that the phrases in italics below are meant to be probing if the participant needs clarification.

1. Tell me about your role in the school.
2. How long have your been teaching?
3. Have you always worked in Div I, Div II, Div III?
4. What does Computer-Assisted Instruction mean to you?
5. Are you familiar with any kind of Computer-Assisted Instructional software, such as *Accelerated Reader, WiggleWorks,* or *Reading for Meaning*?
6. If so, what specific programs are you familiar with? *Reading software programs like WiggleWorks, Academy of Reading.*
7. Where did you hear and/or learn about these programs? *A colleague, a special education coordinator, a school in-service, teachers' convention.*
8. What, in your view, are the advantages of using Computer-Assisted instructional software? *Improves student reading comprehension, allows for small group direct instruction, facilitates differentiated instruction.*
9. In your opinion, what are the limitations of using Computer-Assisted Instructional software? *Cost, classroom computer access, technical requirements.*
10. Do you believe that any form of Computer-Assisted Instructional software could improve the learning experience for students? Can you tell me about that?

11. Is there a particular student that would most benefit from CAI in language arts? *Students struggling to acquire reading skills, unmotivated student, gifted student.*
12. Do you believe that any form of Computer-Assisted Instructional software could improve your teaching experience in language arts? If so, how? *Save time, providing an engaging way to teach specific skills.*
13. Have you used CAI in your classroom?

If answered no, interview continues with:

14. Under what circumstances, if any would you consider implementing CAI in Language Arts?
15. What kind of supports do you feel a classroom teacher needs to successfully implement CAI?
16. Is there anything else you would like to share with me in reference to this topic?

If answered yes, interview continues with:

17. What was the purpose of including CAI in your classroom? *Reward for early finishers, support struggling learners, instructional purposes.*
18. What motivated you to include CAI in your classroom?
19. Did you feel it improved the learning experience of the students using it? How so?
20. Did including CAI improve your teaching experience?
21. What were some of the successes you experienced implementing CAI in your classroom?
22. What challenges and barriers have you experienced implementing CAI in your classroom?
23. What supports, if any did you receive when you first implemented CAI in your classroom? *Initial in-service, classroom visit, webinar.*

24. What supports, if any did you receive to help you maintain CAI in your classroom?

    Follow up in-service, Classroom visit, webinar.

25. What kind of supports do you feel a classroom teacher needs to successfully implement CAI?

26. Is there anything else you would like to share with me in reference to this topic?