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Implementing Technology in the Classroom: Assessing Teachers' Needs Through the Use of a Just-In-Time Support System

Alissa N. Anderson
Wilfrid Laurier University

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IMPLEMENTING TECHNOLOGY IN THE CLASSROOM: ASSESSING TEACHERS' NEEDS THROUGH THE USE OF A JUST-IN-TIME SUPPORT SYSTEM

by

Alissa N. Anderson

Bachelor of Arts, Psychology, Wilfrid Laurier University, 2006

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Abstract

Given the importance of computer technology in classrooms today, it is crucial to identify the types of supports that will facilitate teachers' effective implementation of technology. Ten teachers (four kindergarten, four grade one, and two grade one/two) received just-in-time support while introducing a reading software program in their class. An additional 12 teachers (four kindergarten, seven grade one, and one grade two) were exposed to the software, but did not receive just-in-time support. Both quantitative and qualitative analyses of instructional sessions were conducted in order to determine the kinds of support that teachers required throughout the intervention. Results provided an in-depth look at how the software was integrated within the classrooms. Analysis of the just-in-time support indicated that the greatest number of support requests pertained to computer software related issues, followed by computer hardware related issues, and a smaller number of requests for support regarding classroom management issues, reading related issues, and "other" issues. The greatest level of support was required at the initial stage of implementation, with the number of support requests declining over time; however, the types of support requested did not differ across the stages of implementation. Outcomes based on teachers' self-report responses suggested no significant differences between teachers in the just-in-time support and minimal support only control conditions with respect to computer use, comfort with computers, integration, views on computers, and views on the software program specifically. Student performance indicated that the software program was successful in facilitating the development of reading and pre-reading skills.

Results provide a summary of the kinds of supports required of teachers when planning and implementing a new software program. This study provides instruction for future training in order to ease the transition to computer based learning.

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Media use and, in particular, computer technologies have become increasingly prevalent in the lives of today's youth, both in formal and informal learning contexts (Willoughby & Wood, 2008). The rise in accessibility to computers, both in the home and in the school has been documented throughout the industrialized world (Calvert, Rideout, Woolard, Barr, & Strouse, 2005; Statistics Canada, 2004) and, more recently, within developing countries (Peters, 2008). Along with the increased use of computers in both home and school contexts, there has been a concomitant rise in access to the Internet. For example, among the Canadian provinces of British Columbia, Alberta, and Ontario, approximately 6 out of every 10 households reports being connected to the Internet in their home (Statistics Canada, 2004). These provinces also had the highest reports of Internet usage from home.

Similarly, Internet use has become commonplace in schools. For example, based on data from the 2003/2004 school year, virtually all elementary and secondary schools in Canada had computers and were connected to the Internet . The estimated ratio of computers to student averaged at approximately 1 to 5 (Statistics Canada, 2004). While there has been an evident rise in the availability and accessibility of computers over the years, the use of computers within the classroom context has not risen to the same extent. Several researchers have pointed out that availability of computers does not necessarily translate into practice, especially in the classroom (Mueller, Wood, Willoughby, Ross, & Specht, 2008; Wood, Mueller, Willoughby, Specht, & DeYoung, 2005). Indeed, a growing amount of research has begun to focus on identifying and implementing supports that will facilitate teachers' integration of technology as a meaningful instructional tool in the classroom (Granger, Morbey, Lotherington, Owston, & Wideman, 2002; Mueller et al., 2008; Wood et al., 2005).

The purpose of the present study was to explore "just-in-time" instruction as a support for teachers who were introducing instructionally relevant software in their classroom for the first time. Just-in-time instruction occurs when information, skill demonstration, or other necessary instruction is delivered on the spot at the time that it is required, and as such, information is available for immediate application in the context in which it is required (Hulshof & de Jong, 2006; van Merrienboer, Clark, & de Croock, 2002). In particular, the present study explores the aspects of just-in-time instruction that support teacher integration and implementation of technology as well the barriers that this instructional support fails to provide. The study also examines the impact of the technology on the students who used the software. There are two purposes for assessing student outcomes. First, it is important to determine whether the specific reading intervention had any positive impact on the children. It is possible that positive or negative attitudes and behaviours expressed by teachers may be related to outcomes experienced by their students. Hence, the second goal in measuring student outcome is to see whether student performance with technology impacts in any way upon teachers responses to the technology.

Introduction Roadmap

The introduction begins with a discussion of previous research highlighting the potential benefits of working with computers in the classroom followed by a review of the use of computers as a teaching tool, including many of the existing barriers which discourage or prevent teachers from integrating computers within their classrooms. Various training and support methods that have attempted to overcome some of these barriers are then presented. Finally, "just-in-time instruction" is considered as a potential support which could help to facilitate teachers' use of technology. Although understanding the impact of instruction on students is of importance, the specific focus of the present study is on the educator, and the ways in which educators can be supported in order to foster the successful integration of technology.

Learning with Computers

Previous research has highlighted the unique benefits of computer-based instruction for individuals at all age levels, ranging from kindergarteners to adults. For example, results based on a meta-analysis of 254 studies provided evidence that computer-based instruction programs significantly raised student exam scores (Kulik & Kulik, 1991). Out of 100 studies reporting significant differences between students receiving computer-based instruction and a control group of students who received traditional instructional alone, 94 of the studies favoured the computer-based instruction group (Kulik & Kulik, 1991). Numerous individual studies have documented the positive effects that computer use can have on children's scholastic outcomes (Calvert et al., 2005; Chambers, Abrami, McWhaw, & Therrien, 2001; Espinosa, Laffey, Whittaker, & Sheng, 2006; Lou, Abrami, & d'Apollonia, 2001; McGivern et al., 2007; Naevdal, 2006; Wittwer & Senkbeil. 2007). Academic gains have been found for a wide array of applications, for example, problem solving and mathematics (McGivern et al., 2007; Wittwer & Senkbeil, 2007), as well as preliteracy skills and English (McGivern et al., 2007; Naevdal, 2006). The size of gains is often quite substantial. For example, a meta-analysis examining computer-assisted instruction showed achievement gains where the typical student improved from the 50th percentile to the 63rd percentile on tests when traditional teaching practices were supplemented with computer-assisted instruction (Christmann & Badgett, 2003). The overall positive mean effect size of 0.342 exemplifies the gains that the elementary school students exhibited after receiving computer-assisted instruction compared to traditional instructional alone (Christmann & Badgett, 2003). Additionally, computer-based instruction has also promoted positive changes in student attitudes and motivation level (Chambers et al., 2001; Cole & Hilliard, 2006; Kulik & Kulik, 1991; Means & Olson, 1995) and was effective in substantially reducing instructional time in comparison to conventional teaching methods (Kulik & Kulik, 1991).

Given the importance of reading as a foundation skill in the early learning years, a significant amount of attention has been specifically directed toward reading outcomes associated with computer use. Calvert et al. (2005) found a positive association between the frequency at which a child used computers for activities other than games and the probability of reports from parents that their child could read. Espinosa et al. (2006) also found that the use of a computer at home was positively related to reading achievement in kindergarten and grade three students. The strength of the relationship between computer use at home and reading achievement was also shown to increase, as the children advanced grades.

Apart from global gains in reading associated with computer use, additional research has targeted the effectiveness of computer software programs in aiding the development of specific reading skills. For example, Chambers et al., (2001) looked at a

Computer-Assisted Tutoring (CAT) program called the Reading CAT, designed to help troubled readers who lack access to an expert tutor. The Reading CAT enables children to work on the same material that they are studying during their regular class time, but it allows them to build on that material while engaging in realistic activities that enhance their learning. Use of the Reading CAT resulted in positive reports from both students and their tutors who monitored them while using the program. Tutors reported that children enjoyed using the program and thought it was a great motivational tool. In addition, tutors reported that the program reinforced what was being done in the classroom and in the rest of the tutoring program (Chambers et al., 2001).

While Chambers et al. (2001) provide one powerful example of a software program designed to help early readers, Cole and Hilliard (2006) highlight the benefits of a web-based reading program which features music and video. The researchers discovered that use of the program led to significant increases in reading performance, as well as noticeable increases in the motivation of children who had used the computer program rather than traditional instruction alone (Cole & Hilliard, 2006). In addition, Chera and Wood (2003) found that reading software which consisted of a series of electronic 'talking books' was also effective in increasing phonological awareness among children experiencing reading difficulties.

An additional web-based reading software program which has shown promising results provides a balanced approach to reading. Abrami et al. (2006) specifically assessed the effectiveness of an intervention program, named ABRACADABRA (A Balanced Reading Approach for Canadians Designed to Achieve Best Results for All). ABRACADABRA is comprised of 32 instructional activities. Each activity involves a leveled program where by learners are able to set their level of difficulty which allows them to tailor the program to their specific reading level. The software provides instruction in four main literacy domains: Alphabetics, fluency, comprehension, and writing. Much like Willow's (2002) concept of the "Balanced Literacy Diet," ABRACADABRA combines balanced and motivating instructional activities which cover all of the key components of early reading development. Within the variety of instructional activities, ABRACADABRA provides built-in scaffolding and multiple levels of difficulty which allow for flexibility. ABRACADABRA uses activities which start out by targeting the most basic reading skills such as phonological sensitivity, and then moves on to cover skills such as letter sound recognition, phoneme blending and segmentation, sounding out words, word changing, as well as reading real words within text. Based on a pilot study, Abrami et al. (2006) found substantial reading improvements in kindergarten and first grade children who had used ABRACADABRA compared to a control group of students who had not been exposed to the program.

In addition to the content of the reading software, the context of learning with computers is also important. For example, Lou, Abrami, and d'Apollonia (2001) conducted a meta-analysis looking at numerous studies assessing the use of technology in the promotion of student learning. Of primary concern, were the effects of social context on learning. Specifically, Lou and colleagues sought to answer whether technology is more effective when used individually by students, or when working together, in small groups. Results showed that when working with computer technology in small groups, students produced substantially better group products, along with gaining more individual knowledge than those students learning with computer technology individually (Lou et al., 2001). These positive results indicate that the use of computer technology promotes learning in the classroom, and can be especially effective when used in a group context, rather than on an individual basis or as a stand alone activity.

Teaching with Computers

Although computers are readily accessible among Canadian elementary and secondary schools, there are many challenges to integrating computers in the classroom (Granger et al., 2002; Mueller et al., 2008; Statistics Canada, 2004; Wood et al., 2005). A substantial body of research has identified barriers that limit or prevent the integration of computer-based technology in the classroom. In addition, several researchers have suggested supports that might facilitate teachers' use of technology in the classroom.

Barriers to Technology Integration. Time and equipment are among the more frequently mentioned barriers to the implementation of technology (Franklin, 2007; Granger et al., 2002; Wood et al., 2005). Over time, the availability of hardware has increased; however, there continue to be challenges in compatibility and amount of equipment available (Franklin, 2007). Issues surrounding access and availability to computers within schools are still identified as significant barriers which prevent students from being able to fully utilize computers (Franklin, 2007). When computers are in short supply, teachers experience greater challenges incorporating them into their classroom routine (Granger et al., 2002). Although these are obvious obstacles, some schools have reported finding ways around these limitations by organizing students to work in teams assigned to one computer, or having slower, less capable computers used for simpler programs (Granger et al., 2002), thus leaving the more powerful computers for more complex tasks.

With respect to time, teachers need time to plan computer based learning opportunities into their ongoing lessons. As well, they need time to acquire expertise with new hardware and software in order to be able to integrate them effectively. The importance of in-service training and planning time arises regularly when teachers are surveyed (Franklin, 2007; Granger et al., 2002; Mueller et al., 2008; Wood et al., 2005). The significance of providing up-to-date equipment and training is evident in recent statistics which reveal that more than half of teachers surveyed (59%) integrated computers into their teaching activities "occasionally" or "frequently", while only 7% reported that computers were integrated "almost always" or "all of the time" (Wozney, Venkatesh, & Abrami, 2006). Similarly, when principals were asked to identify technical and communication strengths in their teachers, most indicated that teachers possess the required technical skills to use information and communication technology (ICT) for preparing report cards, taking attendance or recording grades, but slightly less than half of school principals felt that the majority of their teachers were adequately prepared to engage their students effectively in the use of ICT to enhance their learning (Statistics Canada, 2004).

In addition, concerns have been expressed regarding the cost of implementing and managing ICT over time (Statistics Canada, 2004). While slightly more than two-thirds of principals reported that getting sufficient funding for technology was an extensive challenge in using ICT in their school, 90% of principals either slightly or strongly agreed that ICT is worth the investment. Moreover, the vast majority of Canadian principals agreed that the use of ICT encourages a more challenging and enriching curriculum, enabling students to go beyond the prescribed curriculum, and in turn, facilitating learning and increased knowledge gain (Statistics Canada, 2004).

Supports for Technology. For years, many researchers have attempted to identify the barriers which inhibit the use of technology in schools and have looked specifically at what can be done to encourage the use of computers in the classroom (Granger et al., 2002; Mueller et al., 2008; Wood et al., 2005; Wozney et al., 2006; Zhao & Frank, 2003). Zhao and Frank (2003) argue that teachers use computers in a way that addresses their most recent and salient needs. They go on to further suggest that teachers use computers in a maximally beneficial way that does not demand excessive learning time, and does not require them to reorganize their current teaching practices (Zhao & Frank, 2003).

When a new technology or new software program is introduced into a school, this can be viewed as a disruption, or even an invasion of a teacher's classroom, and there are many factors that must be carefully considered before a teacher is likely to alter their current teaching practices in order to implement a new technology in their classroom. Granger et al. (2002) considered contributing factors which have been associated with the successful implementation of information technology in the past. Through the analysis of interview transcripts, Granger and colleagues discovered that many teachers found traditional computer hardware and software instruction to be quite limited and found that a more informal form of collaboration and mentoring with peers resulted in better learning which was more transferable to their classroom teaching (Granger et al., 2002).

Some research has provided promising results concerning workshops targeted at facilitating teachers' learning and reducing anxiety surrounding the use of computers (Wood, Willoughby, Specht, Stern-Cavalcante, & Child, 2002; Chen & Chang, 2006).

Wood et al. (2002) were able to produce immediate reductions in computer anxiety accompanied by an increased level of comfort and basic computer skills following a computer workshop using either a direct or guided method of discovery. Even after a 6-month delay following the workshop, teachers still reported significantly reduced anxiety and greater comfort surrounding the use of computers (Wood et al., 2002).

Chen and Chang (2006) have also provided evidence to support the effectiveness of a training workshop for early childhood teachers. Following a workshop intended to develop teachers' attitudes, teaching practices, and their knowledge and skills surrounding computers, Chen and Chang found that teachers' in the training program did indeed report more positive attitudes surrounding the use of computers in their classroom. This included expectations that computers would be a positive addition to their classroom, along with stronger beliefs that computers would ease the teacher's own work load, while positively benefiting the children during their preschool years. In addition to more positive attitudes, Chen and Chang's (2002) intervention lead to teaching practices which reflected a greater degree of computer integration. Lastly, the workshop was effective in heightening teachers' computer knowledge and skills. Following the workshop, teachers needed less help while using a computer, they reported greater knowledge surrounding the installation of new software programs, and they were more familiar with the appropriate criteria for selecting educational software programs designed for children (Chen & Chang, 2006).

While research does exist which highlights the positive outcomes of computer training programs, other literature suggests that more general training and exposure to computers alone is not as useful as specific, task relevant experience which can be directly transferred into classroom teaching (Granger et al., 2002; Mueller et al., 2008). Teacher interviews have revealed that there does not appear to be any clear relationship between technological implementation and the experience, skills, and education of those engaged in it (Granger et al., 2002). In other words, many teachers who actively integrate technology into their classrooms have admitted to having very limited experience with computers when they began teaching, suggesting that educational background and experience does not account for teachers' use of technology in their classrooms.

Although educational background might not fully account for teachers' integration of technology, their comfort level does seem to have a significant impact (Wood et al., 2005). Wood and colleagues (2005) found that teachers' integration of technology into lesson plans could be predicted by their overall comfort with computer technology. Teachers who reported a higher comfort level with computers were more positive about the implementation of technology and showed a greater level of support for the integration of computers into their classroom curriculum (Wood et al., 2005). Research also suggests that previous positive experiences with computers in the classroom plays a role in teachers' intent to integrate technology in the future (Mueller et al., 2008). These findings suggest that knowledge and skills might not be the most important barrier when it comes to the integration of computers, but rather the teacher's comfort level and anxiety surrounding the use of computers may serve as the most critical issue to address before we can expect successful integration.

An additional dominant and recurrent theme throughout research looking at the barriers to the integration of technology in the classroom is the need for expert support. Although workshops and formal training sessions might be effective for some teachers in enhancing their knowledge and skills, many teachers find that the skills they learn in these sessions are difficult to transfer into regular classroom practice (Granger et al., 2002). This problem may reflect the passage of time between training and actual implementation, as well as the need for training to be interactive, such that problems that were not anticipated in training can be addressed when they occur in planning or in the classroom. Indeed, teachers have identified expert support as one of the most critical supports required to promote effective integration of technology in the classroom (Wood et al., 2005).

Although most teachers are comfortable using computers for personal use, the demands required to translate these skills into classroom planning or troubleshooting are considerably more challenging (Wood et al., 2005). Wozney and colleagues (2006) suggest that teachers do not feel they have the support they need to initiate or implement computer-based programming in their classrooms. Specifically, 38% of teachers reported that access to computer resource personnel within their schools was "poor" or even "extremely poor" (Wozney et al., 2006). Providing relevant and immediate support, therefore, could reduce teacher anxiety and expedite the effective use of computer technology in the classroom. This is because the presence of support can help to reduce the degree of stress that can be aroused from thoughts of the various issues that can arise when using computers (Granger et al., 2002; Mueller et al., 2008). Granger et al. (2002) concluded that full time expert support may be as necessary as the computer equipment itself if teachers are going to move forward toward the full integration of computer technology into their classroom curriculum.

Just-In-Time Instruction

One potential solution for overcoming teachers' challenges in implementing computer technology would be to provide just-in-time instruction during the initial integration period. Just-in-time instruction refers to a type of support that is designed to address problems or issues as they arise. This type of support eliminates the time gap between a problem or question and its solution. Just-in-time instruction is not new to the classroom context, as it has been used as an instructional tool for learners for quite some time. The new application would be to provide the instruction for the teacher rather than the child learner only. Indeed, several researchers have advocated for this kind of instruction. Granger et al. (2002) suggested that just-in-time instructional support could be easily transferred into classroom teaching contexts. Because just-in-time support takes place in the context of teachers' immediate problem, needs, or desires, this need-to-know approach results in an immediate solution, which could subsequently result in a reduction in teachers' anxieties surrounding computer use in the classroom. Researchers also point out that while just-in-time instruction is extremely beneficial during the initial stages of learning, it becomes less important later on, after learners have gained more expertise (van Merrienboer et al., 2002). Just-in-time instruction would therefore be expected to be most relevant when new hardware or software is first introduced. Over time and with increased practice, it would be expected that teachers' need for just-in-time instructional support would taper off.

Just-in-time has proven to be an effective method of support which has facilitated learning in a variety of domains, such as cognitive skills training (Kester, Kirschner, van Merrienboer, & Baumer, 2001; van Merrienboer et al., 2002), simulation training

(Hulshof & de Jong, 2006), as well as for introducing new technologies to teachers in both elementary and secondary schools (Glazer, Hannafin, & Song, 2005; Granger et al., 2002). Kester et al. (2001) found that information presented in a just-in-time manner throughout two 60 minute learning periods was effective in reducing the cognitive load which can come with the acquisition of new complex cognitive skills. Just-in-time support reduces the amount of information that a learner must hold onto in their memory, because information can be presented as they need it. This, in turn, helps to eliminate the decay of other important information that could otherwise be forgotten (Kester et al., 2001).

During scientific discovery learning in a computer-based simulation, Hulshof and de Jong (2006) were able to effectively facilitate learning through the presentation of "information tips" which were presented at the time of learning. Individuals who had received these tips throughout the 50 minute learning process showed significantly better learning gains as measured by a knowledge post-test than those who had no access to information tips throughout the learning process. Other research discusses just-in-time as one element of a four part model that can be used to train and teach a variety of complex skills. It is argued that the just-in-time component of the model is important as it provides learners with the knowledge they need on a step by step basis in order to carry out tasks which can otherwise be quite complex (van Merrienboer et al., 2002).

Just-in-time support has been identified as a very effective method for introducing technology to teachers in both elementary and secondary schools (Glazer et al., 2005; Granger et al., 2002). This method of support has been proven effective in these contexts because, unlike traditional seminars in computers, just-in-time instruction allows teachers to learn within the same context in which they teach. This in turn allows them to practice, reflect, and modify their processes as they see fit based on their experiences within the classroom (Glazer et al., 2005).

Granger et al. (2002) examined the impact of just-in-time support when the support occurred through informal collaboration and mentoring with peers and colleagues within the school. The just-in-time support was more effective than traditional training methods when it came to the transfer of learned skills into classroom practice. Teachers admitted to learning more from their colleagues within the school than they had from instructional sessions on computers (Granger et al., 2002). This is because much of the information taught in instructional sessions is lost before a teacher has a chance to implement what they have learned within their classroom. In turn, most of the learning occurs when teachers provide just-in-time support to one another in order to resolve the issues that arise when using technology in the classroom. The knowledge that teachers are able to pass on to one another can help to immediately resolve a question, which then enables teachers to transfer what they have just learned directly into their teaching (Granger et al., 2002).

In general, the efficacy of just-in-time instruction follows from its ability to provide immediate instruction, targeted at the right level, and as often as is needed to support learning. The opportunity to receive immediate repeated practice for necessary skills may be one of the most compelling explanations for the effectiveness of just-in-time instruction. Specifically, individuals are forced to practice a certain skill at the moment that the skill is required. Research shows that practicing or rehearsing a skill can lead to better retention and a greater likelihood that the skill can be effectively remembered and utilized in the future (VanLehn, 1996). When individuals are given enough opportunity to practice a skill, they can eventually simply retrieve the information necessary to carry out the skill in the future, rather than having to mentally work out the necessary steps (VanLehn, 1996). Because just-in-time instruction offers teachers an opportunity to practice a skill precisely when it is required, it promotes rehearsal which effectively facilitates the learning and memory for that particular skill, relative to traditional training seminars which do not offer the same opportunity for rehearsal.

Additionally, because individuals are forced to practice a certain skill at the moment that the skill is required, just-in-time instruction fosters learning in an authentic learning environment, rather than an artificial environment. Specifically, just-in-time instruction delivers information in the same context in which it is utilized and allows the opportunity for learning by “doing”. In contrast, traditional training seminars are not authentic because they cannot effectively replicate a true classroom context and there is no opportunity to resolve real, unanticipated classroom occurrences. Indeed, research has highlighted the unique benefits of an authentic learning environment and the strong impact that it has on the application of learned skills (Herrington & Oliver, 2000; Lombardi, 2007; Winn, 2002).

It is clear that the level of support teachers receive plays a crucial role in their willingness to integrate computers into their classroom curriculum. It is too much to expect teachers to be fluent in maintenance and troubleshooting issues related to technology, along with hardware, software, and Internet issues. Ongoing external support might be the necessary prerequisite in order to have all educators, regardless of individual differences, integrate technology into the curriculum. The current study explored the effectiveness of a just-in-time external support system designed to aid in the implementation of an Internet-based balanced reading intervention program called ABRACADABRA.

ABRACADABRA was selected because it is one of few programs where the components of the program have been empirically tested (Abrami et al., 2006). Many commercial software programs have not undergone the same level of empirical testing proving the effectiveness of the program. In addition, this study allowed for the assessment of ABRACADABRA in a classroom setting. Previous usage and testing on the program has occurred in a lab setting where instruction was presented by researchers. This study allowed for the assessment of the effectiveness of ABRACADABRA in a natural classroom setting, where the teacher was the one providing the instruction on the program, rather than the experimenter.

Design and Goals of the Present Study

The current study was designed to evaluate the impact of using a just-in-time instructional support system for teachers who were providing a newly introduced, web-based reading instruction program to their students. The study assessed just-in-time support which was made available to teachers as often as they wished over a 10 to 12 week intervention period. This extended period of just-in-time support allowed for a more in depth, qualitative analysis of the demands and questions that arise when intensive support is available.

The primary goal of this research was to map out the kinds of instructional support that teachers required from trained support staff when the staff was made available to assist them before, during, and after their use of the software. By mapping out the types of requests, it was possible to gain a better understanding of the problems and demands teachers experience when they attempt to integrate technology into their ongoing instructional practices. In addition, the extended duration of the just-in-time support made it possible to track changes in requests over time to explore whether there was a shift in the kinds of support that were required as teachers became more familiar with the technology and also whether there was a decrease in the number of requests made as familiarity increased. Qualitative research methodologies were used to obtain this descriptive information. Specifically, field notes were used to assess teacher needs as well as teacher and student responses to the ABRACADABRA software.

Qualitative methods were also supported with quantitative data. Teachers completed surveys which assessed computer integration, views regarding computers and their use in the classroom and views regarding the reading software program. Teachers completed the surveys before and after the intervention which permitted an examination of changes over time. This additional survey data was used to corroborate and understand the qualitative findings.

Although it was important to assess teachers' experiences and perceptions about integrating this technology, it was equally important to verify whether the software actually facilitated learning. Without knowing the efficacy of the reading program, it would be challenging to interpret the teachers' responses and questions. For example, if the software did not promote learning, then challenges faced by teachers may have reflected challenges they saw in improving the children's performance rather than challenges with technology per se. In order to better understand teachers' requests for support, therefore, children's performance was assessed.

Hypotheses and Research Questions

Although the proposed research was exploratory in nature, there were several hypotheses that were explored. The hypotheses are presented below as a function of each component of the study.

Just-In-Time Observations. It was hypothesized that the pattern of the just-in-time observational results would show shifts in the types of support that were requested at the onset of the intervention compared to the end of the intervention. In keeping with previous research on just-in-time support (van Merrienboer et al., 2002), it was also hypothesized that the number of support requests would taper off over time, with the greatest number of requests being presented at the beginning of the intervention, and the fewest requests at the end of the intervention period. The types of supports requested were expected to include hardware and software concerns but the collection of this information was exploratory.

Teacher Outcomes. Given the small number of teachers involved in the present study, the teacher surveys were treated as exploratory. It was hypothesized that teachers who had received just-in-time instructional support would report greater comfort with computers, a higher level of computer integration, and more positive views regarding computers after the intervention than prior to the intervention. It was also expected that teachers who received just-in-time instruction would be more positive regarding comfort with computers, computer integration, views towards computers, and opinions surrounding the software program following the intervention when compared to teachers who used the reading software but did not receive just-in time instruction.

Student Outcomes. Given previous successes with this software (Abrami et al., 2006), it was expected that children would exhibit improved reading skills in the form of improved letter sound knowledge, an increased ability to read sight vocabulary words, and improved phonological blending ability, as a function of being exposed to the ABRACADABRA reading software.

Design

The data for the present study were drawn from a larger Pan-Canadian research study occurring in three provinces. In that larger study, there were two instructional groups (teachers who were requested to use the ABRACADABRA software and those not using the software). Teachers were randomly assigned to each of these conditions within each grade and within each school. The intervention portion of the present study included three groups of teachers and three groups of students; however, data were not equally collected on all three groups. The incomplete design is outlined below in Figure 1. The three groups of teachers included one group who used the reading software program while being supported through just-in-time instruction; one group which received an initial information and training session on the reading software program but received only a minimal amount of support; and finally a group of teachers who did not use the reading software. Teachers were randomly assigned to the two (exposure versus no exposure) conditions but only teachers in Ontario were eligible for the just-in-time instruction. However, random assignment was used to assign teachers to the just-in-time instructional condition versus the minimal support control condition in Ontario. Thus, there were three groups (just-in-time, minimal support only, and no-exposure control). The incomplete design resulted from the timing of the study where control and minimal support groups of teachers could not be contacted to complete the teacher survey prior to initiation of the study. In addition, many survey questions were not relevant for participants in the no-exposure control condition as they assessed the use of computer software and therefore, the teacher questionnaire was not distributed to this group and only the two groups of teachers utilizing the reading software program completed the survey. The children from each of these teachers' classrooms were tested for reading proficiency prior to and after the reading software intervention. The primary goal for including student outcome data was to determine the fidelity of the software program relative to traditional teaching of early literacy instruction and to assess whether teacher evaluations were related to student performance. The most critical comparison, therefore, was the pre-post comparison of the students in the classroom where just-in-time instruction was provided. Comparison with the no-exposure condition was included to determine the impact of the software program on students' learning which could subsequently impact teachers' behaviours and responses. The most critical measure for the present study involved classroom observations where the just-in-time instruction was utilized, yielding qualitative analyses for the just-in-time condition only.

	Pre-Intervention	Intervention Period	Post-Intervention
Teachers			
1) *Just-In-Time*	Survey	Exposure to reading software with just-in-time support	Survey
2) *Minimal Support only Control*		Exposure to reading software (no instructional support)	Survey
3) *No Exposure Control*		Normal Curriculum	
Children			
1) *Just-in-Time*	Reading skills Pre-test	Reading software with just-in-time support	Reading skills Post-test
2) *No Exposure Control*	Reading skills Pre-test	Normal Curriculum No reading software	Reading skills Post-test

Figure 1. Research design prior to intervention, during intervention, and post-intervention.

Teacher Outcomes

The primary focus was a qualitative examination of teachers' experiences with just-in-time instruction. To complete this aspect of the study, only the group of teachers who received the just-in-time instruction were examined. Field notes which were taken throughout the instructional sessions were qualitatively coded in order to assess the various demands and requests that were present when technology was being integrated within the classrooms.

Additional teacher surveys were completed by teachers in the two groups using the software. This allowed for an examination of changes in attitudes toward technology, computer familiarity and experience, and comfort with the technology. Within-group comparisons were made for the just-in-time instruction group between pre- and post-testing. Between-group comparisons were made for the just-in-time and minimal support only groups at post-test only. Unfortunately, it was not possible to control for the minimal support only teachers' pre-intervention attitudes, familiarity and experience, and comfort with technology, as this group of teachers did not complete the survey prior to the intervention, but only after.

Student Outcomes

A mixed 2 X 2 repeated measures ANOVA design was used to assess children's reading skills before and after the intervention interval. The within subjects factor assessed pre-and post intervention performance. The between subjects factor assessed potential differences between the just-in-time and no exposure control groups.

Method

Participants

The present study was part of a larger study which examined children's experiences using a reading software program. The present study assessed a subsample of the total number of classrooms who took part in the larger study. A sample of 22 teachers were included in the present study. Ten of the 22 teachers were randomly assigned to the just-in-time instruction condition and the remaining 12 teachers were randomly assigned to the minimal support only control condition. Within the larger study, teachers were recruited from schools within Ontario, Quebec, and Alberta. Only teachers from Ontario were assigned to the just-in-time condition. All teachers were teaching full-time in either a kindergarten, grade one, grade one and two split, or grade two classroom.

All 22 of the teachers who participated in the study were female. Teachers' ages ranged from 26 years to 59 years (*M* age = 40.75, SD = 10.39). The vast majority (86%) reported that the highest level of education obtained was an undergraduate University degree, while 14% reported having obtained a Master's degree. Years of teaching experience ranged from 2 to 34 years (*M* = 14.09, SD = 10.02). Toward the end of the intervention, one of the just-in-time instruction teachers left the school for a maternity leave, and therefore her post-intervention responses to the teacher survey were not able to be collected.

A total of 312 kindergarten, grade one, and grade two students were assessed (162 female, 150 male) before and after the intervention in the present study. Following the intervention, 17 of the students were dropped from the analyses due to their absence during post-testing leaving a sample of 295 students. Students ranged in age from 3.92 years to 7.92 years (*M* age = 5.93, SD = 0.93). All of the students attended a middle-class school in the Waterloo Region District School Board, Thames Valley District School Board, or Avon-Maitland District School Board.

Materials and Procedure

Informed Consent. Prior to the start of the pre-testing session, teachers were asked to distribute informed consent letters to all of the children's parents in their classrooms. The informed consent statement explained the voluntary nature of the study and the level of involvement required (See Appendix A for example of student informed consent statement). Teachers were also asked to sign an informed consent statement agreeing to their participation in the study as well as their completion of the teacher background questionnaire (See Appendix B for example of teacher informed consent statement).

Teacher Materials

Pre-Intervention Teacher Background Questionnaire. Prior to the introduction of the reading software program, teachers in the just-in-time condition were asked to complete a seven page Teacher Background Questionnaire (Mueller et al., 2008). The questionnaire was comprised of questions which asked for demographic information (i.e., age, sex, education) as well as information about computer use at home and at school, comfort with computers in general and in the classroom, school access to computers, computer integration in the classroom, and computer views (See Appendix C for full example of the pre-intervention teacher background questionnaire).

Teachers' computer use at home and at school was assessed by asking them to identify on average, how many hours or minutes per week they spend on their home computer and on their school computers. Comfort with computers, both in general and in the classroom, was assessed by asking teachers to respond to two questions in which they rated their level of comfort surrounding computer use in general and in the classroom (Mueller et al., 2008) on a 5-point Likert-type scale (1 – *Very Comfortable* to 5 – *Very Uncomfortable*). Computer integration in the classroom was a composite of nine items (Cronbach's alpha = .87). Three of the items asked teachers to: Rate their ability to integrate computers compared to the average teacher; rate the extent to which they integrate computer technology in the classroom; and rate how often they assume that computer use by students will be a part of their instructional plan, using a 5-point, Likert-type scale (with anchors ranging from 1 – *much less skilled/not at all*, to 5 – *much more skilled/a great deal*). The remaining six items asked teachers to report on the frequency of computer integration within their teaching of six different areas (pre-reading/reading, writing, mathematics, social studies, the arts: music, and the arts: visual arts) on a 5-point Likert-type scale (1 – *never* to 5 – *a great deal*).

Finally, computer views were assessed by asking teachers to indicate their level of agreement for 27 items (Cronbach's alpha = .86), using a 5-point, Likert-type scale (1 - *strongly disagree* to 5 - *strongly agree*) (See Mueller et al., 2008; Wood et al., 2005). Based on a previously completed factor analysis of the 27 items (Mueller et al., 2008), eight of the items were dropped from the analyses (items 2, 11, 12, 17, 18, 19, 20, and 21). The remaining items were grouped into four factors: Computers as an instructional tool (items 1, 3, 4, 6, 7, 10, and 23; Cronbach's alpha = .85); positive computer experiences (items 22, 24, 25, 26, and 27; Cronbach's alpha = .68); technical issues (items 13, 14, 15, and 16; Cronbach's alpha = .79); and computers as a motivational tool (items 5, 8, and 9; Cronbach's alpha = .69).

Post-Intervention Teacher Background Questionnaire. Following the intervention period, teachers in the just-in-time group and teachers in the minimal support only control condition were asked to complete a post-intervention questionnaire. Teachers were asked to sign a consent form (See Appendix D for the post-intervention informed consent form). The questionnaire was identical to the *Pre-Intervention Teacher Background Questionnaire*, with the addition of several questions asking teachers to rate their experiences with the reading software and the available support (See Appendix E for the full questionnaire).

Views toward the reading software program were assessed using a 6-item, Likert-type scale generated for the purposes of this study. Reliability for the scale was high (Cronbach's alpha = .97). The six questions asked teachers to rate the degree to which they: Liked teaching with the software; the students enjoyed learning with the software; the software was easy to use; whether it was easy to teach students with the software; whether the use of the software helped students to learn; and whether the use of the software made teaching easier, using a 5-point Likert-type scale (1 - *strongly disagree* to 5 - *strongly agree*). A seventh question asked teachers to rate how effective they found the initial training session to be in preparing them to implement the software within their classes. Specifically, teachers responded to the following question, "Was your training good preparation for using the software?" and were asked to indicate their level of agreement on a 5-point Likert-type scale (1 – *strongly disagree* to 5 – *strongly agree*).

An overall view of the helpfulness of the available support was comprised of three items (Cronbach's alpha = .85), which asked teachers, "How often do you need help to use the ABRACADABRA program?", "When you needed help, how often did you seek the assistance of the in-class research assistant?", and "How helpful was it to have the in-class research assistant available?" using a 5-point Likert-type scale (1 – *never/not at all helpful* to 5 – *regularly/very helpful*).

Finally, teachers were presented with an open-ended question which asked who they would have resorted to as a source of help, had the support staff been unavailable. Specifically teachers were given the following question, "What source of help would you have used if a research assistant was not available?" in order to allow teachers to describe common sources of support when using new technologies.

Teacher Training Workshop. Once the pre-testing sessions for children had been completed, all teachers were introduced to a reading software program called ABRACADABRA (Abrami et al., 2006; Hipps et al., 2005) during a half-day teacher training session. Teachers were provided with a replacement teacher for their classroom so that they could attend this training workshop. During the session, teachers were presented with information outlining the background and creation of ABRACADABRA, the specific tools and information needed to navigate the program, and some suggested implementation techniques that they could choose to use themselves, in their classrooms. Teachers were provided with opportunities for hands-on experience with the program and were encouraged to ask questions or offer comments that they had about the ABRACADABRA program during this time. These sessions were facilitated by a representative from the Center for the Study of Learning and Performance (CSLP), where the software originates and is regularly evaluated and updated. The facilitators who delivered the training session to teachers were trained teachers as well as literacy specialists which allowed teachers to ask questions specific to the software and how the software could be used in reading contexts.

Reading Software Program. Teachers were asked to use the reading software program in their classrooms for a total of about two hours of instruction per week. ABRACADABRA is a technology based reading intervention program designed to provide a balanced reading approach in early elementary classrooms (Abrami et al., 2006; Hipps et al., 2005). The program provides instructional activities in four main literacy domains. These domains include alphabetics or phonics based activities such as blending and segmenting; reading fluency or text level activities such as tracking and reading with expression; comprehension activities such as story sequencing and summarizing the story; and writing activities which consist of spelling words and sentences. The program consists of 32 activities in total that are linked to 17 stories, which vary in their level of difficulty. Within the alphabetics area of the program, there are 17 activities available; five activities are available within the reading fluency area; eight activities within the comprehension area; and two activities in the writing area of the program. Because of the built-in scaffolding and multiple levels of difficulty, the program is highly interactive, flexible, and can be geared towards a variety of reading levels. Previous research supports the efficacy of the software program for promoting learning in reading (Abrami et al., 2006).

Software Use in the Classroom: The Intervention. The entire intervention period lasted approximately 10 to 12 weeks in each classroom. Teachers chose to implement the program in a manner best suited to their needs and the needs of the children in their classroom. It was important that teachers utilized the program in a way that would reflect their own teaching practices and therefore, teachers were encouraged to use the program in a way they felt was best. Teachers were, however, provided with a suggested outline for the use of ABRACADABRA within their classrooms. This outline suggested the use of two, one-hour lessons per week comprised of ten minutes of word-level work with the alphabetics activities, 15 minutes of text-level work using fluency and comprehension activities, 20 minutes of collaborative work in which students could work in small groups in a particular element, and 15 minutes on extension work which could be related to the activities they had completed in ABRACADABRA. It is important to note though that this outline was given as a suggested usage structure, and it was left up to teachers whether or not they chose to follow the outline or create their own.

Teachers were also able to choose the degree of implementation within their classroom. This consisted of whether they chose to use the software with the entire class together, in small group settings, individually, or as a "centre" such as is often found in kindergarten classrooms (with one or two computers to be used at a time). In addition, to facilitate use of the software, teachers were provided with two portable laptop computers per classroom which they could set up in their classroom for individual or center use. Teachers were also encouraged to use the laptops for their own personal use during planning time. These laptops were available to teachers in both the just-in-time and minimal support only conditions.

In the just-in-time instruction condition, between one and four facilitators, who were trained on the software program and computers, were available to be present in the classroom at the time that ABRACADABRA was being used. The level of support varied based on the requests from the teacher and how much support they felt was needed in their classroom. In addition, teachers were provided with contact information for a reading specialist whom they could call at designated times (arranged in consultation with the teachers) so that the expert could be accessed during planning or follow-up to class use of the ABACADABRA software. Finally, within each school, teachers were provided with additional technology resources through contacts with their board Information Technology Services (ITS) staff. In this way, just-in-time teachers had full support during planning with use of the software, on-site use of the software, and follow-up questions and queries.

The facilitators coordinated with the teachers ahead of time in order to arrange when they should come in for observation. Just-in-time support and observations occurred over the entire 10 to 12 week intervention period. All facilitators were trained concerning the types of observations that should be made and how they should be recorded. This was done in order to ensure consistency among the observations of the different facilitators. During the observation time, each facilitator positioned themselves unobtrusively within the classroom in order to observe the naturalistic classroom occurrences. Facilitators recorded observations on how the teacher implemented the program along with the children's responses to the program. Each facilitator was available to the teacher and the students for any questions, comments, or support that was requested of them during this time. Facilitators only offered support when it was sought, but recorded any issues that arose, regardless of whether help was sought from them. The facilitators were there not only to observe the intervention in action, but also to troubleshoot when any concerns or problems arose.

Just-In-Time Observation Sheets. A standard form was used when recording observations during the just-in-time instructional sessions. The facilitators recorded the session length, the number of students observed, the observed activities, and any other pertinent details. Specific questions were included in all field notes for the quantitative ratings but each of these was followed with space to allow the observer to provide a qualitative explanation which could later be used to support the ratings. The overall degree of implementation was assessed on a three point scale ranging from *none* to *full.* The degree of implementation referred to the scale at which the computers were being used within the class. For example, a rating of full was given when the entire class was using the software at one time. A rating of partial was given when only part of the class was using the software, such as during center time. A rating of none was given in the rare event that no students were using the software during a time in which the software was available for use.

The fidelity of instruction was assessed on a three point scale including *poor, average* and *excellent.* Fidelity of instruction referred to the degree of instruction that was offered to students when using the software. A rating of poor was given when very little or no instruction or direction was offered to students. This category included instances where students were not encouraged to use the program, and where students were not being monitored at all while using the program. A rating of adequate was given when a sufficient level of instruction was provided, such that students were able to initiate their session with ABRACADABRA and the students were able to engage with the software for the instructional session relatively independently, however, in this category it was possible that students would be unclear as to the "game" they should be working on or the general purpose for the game they were using. A rating of excellent was given when detailed instruction or directions were provided to students, including which activities they should be working in and at what levels, students being grouped and guided based on their specific needs, and the teachers' expectations of the students were made explicit. For a complete list of examples of the qualitative explanations for each category rating of Fidelity of Instruction, see Table 1.

In addition, student involvement was also assessed on a three point scale ranging from *poor* to *excellent.* Student involvement referred to the degree of student engagement and the level of off task behaviour. A rating of poor was given when there was very little student involvement or engagement and, in some cases, a high level of off task behaviour. Low student involvement was characterized by children attending to other children or distractions in the classroom environment, playing other software games, playing with the devices in non-game related ways, sitting without engaging in any activity or fidgeting rather than attending to the game. Student involvement was rated as adequate when students appeared to be relatively engaged and off task behaviour was minimal and short lasting, and a rating of excellent was given when students were very engaged with the program, appeared motivated and eager to participate and finish the activities before moving on, and when very little or no off task behaviour was observed. For a complete list of examples of the qualitative explanations for each category rating of students' level of involvement, see Table 2.

The facilitators were also instructed to record any and all questions and requests for support before, after, and throughout each session. These recorded incidences were then categorized as computer software issues, hardware issues, classroom management issues, reading issues, or "other". Any additional comments, questions, or suggestions from teachers were also recorded throughout the 10 to 12 week period in which the classroom was using the software program (See Appendix F for example of the just-in-time instruction observation sheet).

Children's Materials

Pre-test Sessions. During the pre-testing sessions, a group of researchers worked one-on-one with students in a quiet area of the school that the school's principal had designated. The pre-test measures for the children consisted of a Letter Sound Knowledge task (Cronbach's alpha = .97), Fry's Instant Word List (Fry, 1980; Cronbach's alpha = .96) which tests the students' ability to read a selected sample of sight vocabulary words, and the Comprehensive Test of Phonological Processing blending task (CTOPP; Wagner, Torgesen, & Rashotte, 1999; Cronbach's alpha = .86). These measures were delivered alongside other measures which were part of the larger study assessing the effectiveness of the software program. The entire pre-testing session took approximately 15 minutes per student.

Letter Sound Knowledge. Students were presented with a page which displayed, in random order, all of the 26 letters of the alphabet in lower case. Students were then instructed to "Have a look at these letters. Can you tell me the sound that goes with these letters?" In the case that a child responded with the letter name, rather than the sound, they were instructed, "That is the name of the letter. Can you tell me what sound goes with it?" Students received one point for each correct letter sound given for a total score out of 26 (See Appendix G for example of letter sound knowledge scoring sheet).

Fry's Instant Word List. Following the Letter Sound Knowledge task, children were randomly presented with and asked to read aloud 20 words which were randomly selected from Fry's Instant Word List (Fry, 1980), as a measure of their ability to read sight vocabulary words. Children were not given feedback regarding the accuracy of their responses. A score of (1) was given for each word read correctly, and (0) for each incorrect response. Based on the number of words read aloud correctly, children received a raw score out of 20 (See Appendix H for example of Fry's word list scoring sheet).

Auditory Blending. The final pre-test measure administered to the children assessed children's ability to blend segments of speech into whole words using the blending subtest from the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999). Children were presented with a CD which read out word segments and asked the child to identify "what word do these sounds make?" In the CTOPP, trials were presented in such an order that they gradually increased in difficulty. The simplest trials required children to blend syllables to form simple words, such as "candy," whereas the most challenging trials required children to blend the individual phonemes of longer, more difficult words, such as “mathematics”. The CTOPP consisted of six practice trials with corrective feedback, three test trials in which children received feedback about their accuracy, and 17 test trials where the child received no feedback. Children were given an overall raw score out of 20, based on the number of test trials answered correctly.

At the end of each session, all of the children were given the opportunity to choose from a selection of stickers for their participation. In the event that a child appeared distressed or was having trouble staying on task during one of the sessions, they were offered a stamp or a sticker in an attempt to regain their attention.

Post-Test Sessions. Within two weeks of the end of the 10 to 12 week intervention period, children were administered post-test measures identical to those used in the pre-test sessions. All students were once again administered the Letter Sound Knowledge measure (Cronbach’s alpha = .96), Fry’s Instant Word List (Fry, 1980; Cronbach’s alpha = .98), and the CTOPP blending task (Wagner et al., 1999; Cronbach’s alpha = .87). In addition, a measure comprised of two questions was developed and administered to all students who had been exposed to the reading software. The questions assessed to what degree the children enjoyed playing on ABRACADABRA, as well as the children’s perceived amount of time spent playing on ABRACADABRA. Specifically, children were asked, “Can you show me how much you enjoyed playing on ABRACADABRA?” Children used a 5-point Likert-type scale which used facial expressions to represent the different emotions. The anchors ranged from *Very Unhappy* to *Very Happy*. Children were also asked, “Can you show me how often you played on ABRACADABRA?” The children were once again asked to base their response on a 5-point Likert-type scale which used pictures of children on a computer to represent the amount of time spent playing on ABRACADABRA. The scale ranged from *Never*, where there were no pictures to represent time spent, to *A lot of the Time*, where there were four pictures of children playing on a computer (See Appendix I for example of student post-test measure). Once again, these measures were embedded within others which were included as an overall assessment of the software program for a larger study. The entire duration of the student post-testing sessions lasted approximately 20 minutes in length.

Once the post-testing had been completed, classrooms that had been randomly assigned to the no-exposure control condition were given the opportunity to use ABRACADABRA in their classrooms. The teachers in the control condition were also given the same teacher training session as was previously given to the teachers in the exposure groups and support was provided in their classrooms similar to that offered through the just-in time instruction.

Results

Four aspects of the data were analyzed. First, the observations of the instructional sessions for the just-in-time condition were assessed. Second, the analysis of just-in-time instructional support was examined. Third, teachers' responses to the survey were explored, and, finally, student outcomes were assessed.

Observations of the Instructional Sessions

A total of 80 instructional sessions were observed across the ten classrooms using ABRACADABRA with just-in-time support. Of the 80 instructional sessions observed, 41% were in Kindergarten classrooms, 25% were in grade one classrooms, and 34% were in grade one and two split classrooms. Within each observation, a record was made of the total session length, the number of students using the software, the degree of implementation, the focus of the session, the fidelity of instruction, and the level of student involvement. Inter-rater reliability was calculated for the degree of implementation, the fidelity of instruction, and the level of student involvement based on 28% of the observations in which two independent observers were observing in the classroom at one time. Inter-rater reliability is reported below for each topic observed. Finally, any issues or requests for support were recorded in order to track the types of challenges that teachers faced when integrating the new technology within their classrooms.

Session Length. Overall, the observed instructional sessions ranged in length from 14 to 90 minutes and averaged approximately 35 minutes in length ($M = 35.24$ minutes, SD = 12.61). Given that teachers were provided with a 45 minute time frame for ideal use of the software for each session along with a suggested 15 minutes of extension work, it seems as though, on average, teachers were using the software for slightly less time for each session than was recommended. Teachers' own self reports of their use of the software within their classrooms were consistent with observations. Teachers reported using the software for an average of 34 minutes ($M = 34.00$, SD = 3.78) in a typical session, and on average, reported using the software two times per week in their classrooms ($M = 2.38$, SD = 1.09). It was clear that there was a lot of individual variability regarding session length.

Student Involvement and Degree of Implementation in the Classroom. On average, approximately 14 students ($M = 14.05$, SD = 6.00) were engaged with the software during each session it was in use, suggesting that the software was being used in whole class instructional settings more so than individual or small group settings. This was verified using the degree of implementation recorded for each instructional session.

The degree of implementation within each classroom session was assessed on a three point scale ranging from *none* to *full*. Full represented whole class involvement with the software, partial identified when a portion of the class was involved and none indicated that the software was available but not being used. Inter-rater agreement for the degree of implementation scores was very high at 95%. Disagreements were resolved through discussion. In 80% of the sessions there was full implementation. In 18% of the sessions only a portion of the class used the software within the instructional session. In very few cases the software was available but not being used (2% of the sessions). As suggested above, teachers primarily used the software as a whole class activity rather than for small group or individual instruction. Also, when the software was made available, it was most often utilized.

Focus of the Sessions. The reading software program contains activities which are grouped into four main skill-training areas. These areas include alphabetics, or phonics based activities such as blending and segmenting; reading fluency or text level activities such as tracking and reading with expression; comprehension activities such as story sequencing and summarizing the story; and writing activities which consist of spelling words and sentences. The vast majority of sessions involved the alphabetics training units (83% of the sessions) followed by reading fluency (63% of the sessions), then comprehension (41%), and finally, writing activities (26%).

To determine whether the focal area of the program changed over time, the target activities from the first two sessions were compared to the activities used in the last two sessions for each classroom and session. Visual inspection of the patterns of use for each of the four focal areas suggest that while the alphabetics activities served as the primary focus of the first two sessions (92%), use of this component of the software remained high but to a lesser degree in the final two sessions observed (73%). In contrast, the tendency to focus on the reading fluency section of the program remained somewhat stable over time and differed only slightly between the first and last two sessions (63% and 68%, respectively). While the comprehension area of the program was not commonly used in the beginning sessions (21%), its use became much more frequent in the final sessions observed (64%). Similarly, the writing activities were far less commonly used when the program was being introduced in the first two sessions (13%) compared to the final two sessions observed (50%). These descriptive differences indicate that all components of the software were present, to some degree, at the outset and at the conclusion of the intervention. This reflects congruence between the instructional design of the software and pedagogy regarding teaching of reading (Hipps et al., 2005), that is, that reading instruction requires a balance between the many underlying skills. The differences in the relative use of the different areas within the software over time likely reflect a change in skill level over time with students acquiring more basic skills and being able to engage in more complex activities.

Examinations of potential differences in software use within grades and across grades were compared by conducting a 4 (focus topic: alphabetics, reading, comprehension, writing) X 2 (grade: kindergarten vs. grades 1 and 1/2) repeated measures analysis of variance (ANOVA). The focus area served as the within subjects factor and grade served as the between subjects factor. Comparisons were made between the youngest learners (junior and senior kindergarten) versus their older peers (grade 1 and grade 1/2). There was one significant main effect for program focus, $F(3, 231) = 57.54, p < .001$, indicating significant differences among the use of the four areas of the program. The main effect of grade level was not significant, $F(1, 77) = .69, p = .408$. The significant main effect of focus, however, was qualified by a significant focus by grade level interaction, $F(3, 231) = 5.55, p = .001$, indicating that the differences between the younger learners' use of the alphabetics area compared to the other areas were far more substantial than the differences that the older learners exhibited between alphabetics and the remaining areas of the program. This interaction is displayed below in Figure 2.

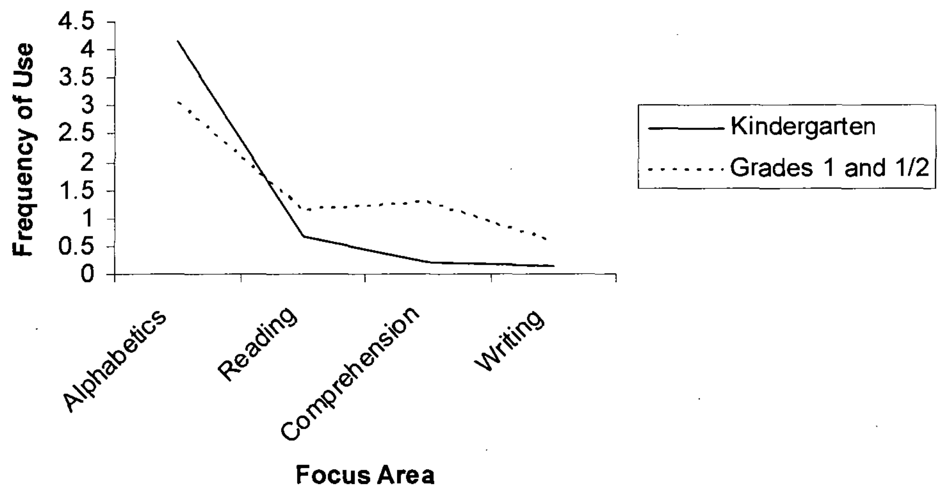

Figure 2. Frequency of use within each area of ABRACADABRA by grade level interaction.

Paired samples t-tests comparing the differences between each focal area as a function of grade indicated that the kindergarten learners' use of the alphabetics area of the program was significantly greater than use of the reading area, $t(32) = 5.70, p < .001$, the comprehension area, $t(32) = 6.40, p < .001$, and the writing components, $t(32) = 6.27$,

$p < .001$. Kindergarten learners' use of the reading area was also greater than that of the comprehension area, $t(32) = 3.92$, $p < .001$, as well as the writing area of the program, $t(32) = 3.72$, $p = .001$. There were no differences found in kindergartens' use of the comprehension area of the program versus the writing area of the program, $t(32) = .57$, $p = .572$.

Similar to the younger learners, grade one and two students made use of the alphabetics area more often than the reading area, $t(45) = 4.85$, $p < .001$, the comprehension area, $t(45) = 3.77$, $p < .001$, and the writing area of the program, $t(45) = 5.64$, $p <.001$. In contrast to the kindergarten students, grade one and two students' use of the reading area did not differ from the comprehension area, $t(45) = -.45$, $p = .654$, although it was significantly greater than use of the writing area of the program, $t(45) = 3.94$, $p < .001$. Finally, grade one and two students' use within the comprehension area was greater than use within the writing area, $t(45) = 3.30$, $p = .002$, unlike the kindergarten learners who showed no differences.

Fidelity of Instruction. It was important to assess the quality of use of the software program as an instructional tool for each session. To do this, the fidelity of instruction was also assessed on a three point scale ranging from *poor* to *excellent*. Fidelity of instruction referred to the level of instruction or direction that was provided to the students when using the software. Inter-rater agreement for fidelity of instruction across sessions was high at 91%. Disagreements were resolved through discussion. For a complete list of examples of the qualitative explanations for each category rating of fidelity of instruction, see Table 1.

Overall, 47% of the sessions were rated as excellent. A score of excellent indicated that the teachers provided a clear, structured program for the students with explicit expectations. This included which activities students should be working in and at what levels in addition to teachers' grouping of students based on their ability levels. Examples of lessons which were rated as excellent included the teacher directing the students toward activities which related to current work being done in the classroom; structured lessons in which the students were offered whole-class instruction on a particular activity before attempting the activity on their own; and the teachers' division of the class into smaller groups (based on their ability level) with each group being directed to work on specific activities which corresponded to the skills on which they most needed to work.

In 39% of the sessions observed, a rating of adequate was given. This indicated that a sufficient level of instruction was provided, such that students were able to independently play on the program and that the students had some general awareness of what was expected of them during the instructional session. Examples of adequate ratings included instances where activity choices were given to students, but may not have been monitored or reinforced throughout the session; and free choice sessions where no formal instruction was offered to the students.

In 14% of the sessions, a rating of poor was given to indicate that no explicit instruction or direction had been provided for the students regarding the use of the software. In these lessons little or no supervision from the teacher was given when using the software program; no instruction or direction regarding appropriate activities or levels that the students should be working on was provided; and there were instances in which the students' use of the software program was not encouraged or monitored at all.

Student Involvement. Student involvement was assessed on a three point scale ranging from *poor* to *excellent.* Student involvement reflected the level of engagement of the students for the task at hand. Agreement between raters for the level of student involvement across observed sessions was high at 91%. Disagreements were resolved through discussion. For a complete list of examples of the qualitative explanations for each category rating of student involvement, see Table 2.

In total, 70% of the sessions were rated as excellent meaning that the children were engaged in the activities and there was little or no off task behaviour. In 22% of the sessions, student involvement was rated as adequate meaning that the level of student engagement was good and there was some off task behaviour but these episodes were short and varied across individuals throughout the session. Finally, there were 8% of the sessions which were rated as poor. In these cases, students were not engaged with the software and there was a high degree of off-task behaviour, logging out of the software, playing other games or activities on the computer, or cases in which students did not participate at all and refused to use the software program all together.

Correlations were conducted in order to assess the relationship between the fidelity of instruction and the level of student involvement. The significant positive correlation, $r = .546, p < .001$, suggests that higher levels of student engagement and a higher rating of the fidelity of instruction were positively related.

Analysis of the Just-In-Time Support

Observations collected throughout the instructional sessions were analyzed using an inductive coding technique (Strauss & Corbin, 1990). Issues and requests for support, recorded in the field notes, were read to determine the presence of common themes. Theme labels were determined using phrasing or words found in the observational notes. As similar issues and requests for support were encountered, theme labels were revised and more general or abstract labels were developed (Sahin, 2003). These new labels and their definitions reflected the growing constellation of items captured by the theme while still attempting to retain the wording of the observational notes. The observational notes had one structural component, namely five headings were outlined in advance, including, computer hardware issues/requests, computer software issues/requests, classroom management issues/requests, reading related issues/requests and "other" for observations which did not fall under any of the previous categories. To ensure reliability of the coding, and to protect against projection, an explicit scheme for theme labels, definitions and examples was developed (Boyatsis, 1998). The resultant coding scheme was used to code 25% of the responses by two independent raters. Percentage of agreement was 93% for computer hardware issues/requests; 96% for computer software issues/requests; 88% for classroom management issues/requests; 80% for reading related issues/requests; and 100% for "other" issues. Any discrepancies in the codes were compared, discussed and resolved through discussion. Final adjustments were made to the coding scheme and definitions before utilizing the final coding scheme to code the entire set of observations.

Furthermore, each documented issue or request for support was categorized as resolved or not resolved. An observation was considered resolved when the issue or problem was solved such that the student or teacher was able to continue working with the software as was originally intended. Observations were coded as not resolved when an immediate solution was not found and the issue or problem could not be solved, even with the help of the just-in-time support staff.

A total of 187 issues or requests for support were documented across the intervention period. Among these, 176 (94%) occurred during the instructional sessions and 11 (6%) were presented to the just-in-time facilitators before or after the instructional sessions (See Table 3). Just over half of the requests for assistance were related to computer software (52%). An additional third of the requests involved computer hardware issues (32%). Classroom management issues accounted for 11% of the total number of requests for support, while requests involving reading skill development accounted for 3% and "other" issues for 2% of the concerns requiring assistance during the instructional sessions (See Figure 3). A closer examination of these issues is presented below.

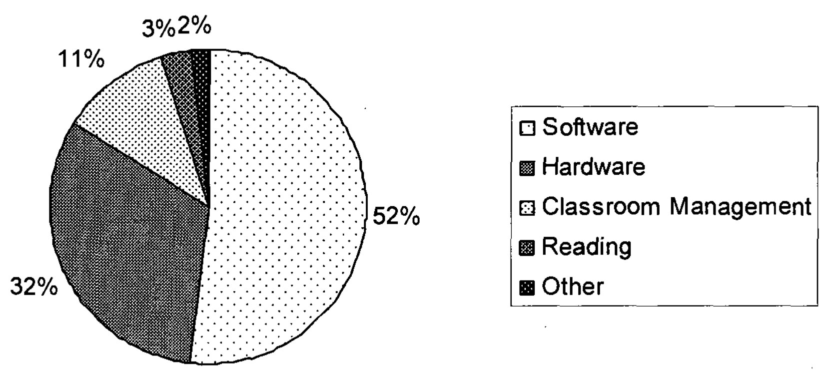

Figure 3. Breakdown of the types of issues observed when just-in-time support was present.

Software Issues. Among the 97 observations categorized as computer software related issues, a total of eight themes emerged (See Table 4). The most common theme dealt with confusion surrounding how to *navigate* the software (35% of the issues). Examples of such navigational issues dealt with confusion surrounding specific story-to-activity links that exist within the software program, as well as specific icons that act as shortcuts to the various screens within the program. For example, help was often requested because the user did not know how to return to the "secret room" to choose another activity to work on, and needed to be reminded about the *magic desk* icon which is offered as a shortcut and allows the user to quickly return to the secret room.

Another common theme dealt with issues that arose as a result of a *software glitch or malfunction* (23% of the software related issues) and were characterized as instances where the software program was not working as it should under normal circumstances. Examples included instances in which the program failed to respond when a student was working in an activity, or instances in which the software was performing especially slowly. Requests for support during computer *start-up* or during the *log-in process* accounted for 16% of software related support requests. This most often included situations in which the students required assistance logging-in to the computers and starting up the software program. Confusion surrounding *how to play* an activity accounted for 13% of the issues that arose and these were due to a misunderstanding or lack of knowledge surrounding the specific activity that was being played and its instructions.

In a fewer proportion of cases, *frustration with an element of the software program* (7% of the issues) served as a concern. These involved instances where the software was performing as it should, but the teacher or student was frustrated with its performance. Examples included an expressed frustration with the speed of certain activities. Specifically, some teachers complained that certain activities were too slow which, in turn, frustrated the students when working on them. Other points of frustration dealt with an absence of features which teachers would have preferred to be a part of the software program. For example, one teacher expressed frustration over the lack of feedback that the student received in a particular activity when they responded incorrectly and felt that feedback should be provided both in the event of an incorrect or correct response.

Issues surrounding the *internet browser* or *connection* accounted for 3% of support requests. For example, concerns would arise when the browser would report "page not found". Issues that dealt with *bookmarking* accounted for 2% of requests made and these dealt with requests from the teacher asking that the software program be bookmarked for the students in order to make it easier for the students to get into the program on their own. The final software related request dealt with issues or questions surrounding the *implementation* of the software program and how it should be implemented within the classroom (1% of the issues). Specifically, this type of request dealt with a concern for how long the students should work on a specific activity before moving on.

Among the 97 documented issues or software related support requests, 77% were resolved with the help of the just-in-time support staff, and 23% could not be resolved with an immediate solution. Upon examination of the requests which were not resolvable, it became clear that two themes accounted for the majority of the unresolved concerns.

Issues dealing with glitches with the software itself (i.e., slow software performance or an activity not performing as it should) were the most commonly unresolved (accounting for approximately 45% of the unresolved cases). In addition, frustration surrounding an element of the software was a commonly unresolved issue (32%). None of the recorded frustration issues were resolved. Because the frustration issues were a function of the design of the software it would not have been possible to alleviate concerns in this area. The majority of the unresolved software related issues, therefore, were products of the design of the software, and were not due to inefficiencies among the support staff.

Hardware Issues. Sixty requests involved computer hardware issues. Within this broad category, eight themes emerged (See Table 5). Issues or requests surrounding *headphones* were the most prevalent, accounting for 30% of computer hardware issues. Included in this theme were a lack of headphones, defective headphones, and improper use of headphones (e.g., improper volume adjustment).

Issues surrounding the use of the *mouse* most often occurred when students' experienced difficulties controlling or operating the mouse (20% of issues observed). There were several instances where *adjustment of the computer set-up* was required (13% of the issues). Examples of adjustments included screen size re-adjustment, resetting the settings on the desktop, resolution, or the keyboard settings. Other themes involved problems with the central processing unit (CPU). Specifically, *slow computer function* accounted for 10% of the issues, while 7% of the issues related to the computer being *frozen* which prevented use of the program. The inability to network classroom computers accounted for 8% of the issues and these involved the computers in the classrooms which were set up for station use. Issues surrounding the use of a *data* *projector* for full class instruction also accounted for 8% of the computer hardware issues. Finally, *defective speakers or computer sound* accounted for the final 3% of the issues or support requests that related to the computer hardware.

Of the 60 instances where computer hardware issues arose, 63% were classified as resolved, and 37% as not resolved. Overall, two hardware concerns accounted for the majority of the unresolved issues. Concerns with headphones served as the most prevalent unresolved issue (36%). In the majority of these instances, a lack of headphones was the issue, and this came as a result of a lack of money or resources which could be allocated toward the purchase of headphones. Specifically, when headphones were not able to be acquired in the session, the issue was classified as unresolved. An additional 18% of the issues not resolved dealt with the projector and an inability to get it working within the instructional session. Specifically, issues arose where the projector would not connect with the main computer in order to project the activity for the entire class to view. In another instance, the projector screen itself was broken and would not stay in place, and therefore the teacher was unable to use the projector for whole class use during that session.

Classroom Management Issues. A total of 21 issues dealt with the behaviour of the students while in the instructional sessions. Within this category, six themes emerged (See Table 6). The most common theme (accounting for 32% of classroom management issues) involved students not following the teachers' instructions by being on the *incorrect activity within* the software program. Another common theme dealt with *incorrect use or play* within an activity in the program (28%). In these instances students were not doing the task as it is intended in the activity. For example, these were evidenced when students failed to complete the task within the activity and simply waited to play the game aspect of the activity without doing the desired task. The remaining four themes within classroom management each accounted for 10% of the issues observed in this category. Instances were documented where students were *restless and unengaged* with the software program. Other issues involved students not following teachers' instructions by *moving to another game* on the computer during specified ABRACADABRA time. Instances were also recorded in which students *refused to participate* in the instructional session altogether. The final theme involved difficulties with small group sessions. In particular, here it was noted that *extra supervision* was required in order to keep the students on task and to ensure that the students worked cooperatively with one another.

A total of 62% of the classroom management issues were able to be resolved within the instructional session, while 38% were classified as not resolved. Among those not resolved, two major themes were involved. Issues most often dealt with students playing on the incorrect activity within the program (25% of the issues that could not be resolved), or alternatively, engaging in incorrect play within the desired activity, that is, not doing the task as it is intended within the activity (38% of the unresolved issues). Interestingly, these concerns were not resolved because no help was sought from the facilitators nor did the teacher monitor or correct this on their own. It is possible that just-in-time help was not sought from teachers in this area because teachers may have been apprehensive to ask for help in the area of classroom management as they may have felt that this was a skill they should have as a teacher. Alternatively, it is possible that teachers may have simply not noticed when the above mentioned issues were occurring in the classroom, which may have accounted for why they did not seek help from the just-in-time support.

Reading Related Issues. A total of five issues or support requests were observed that related to reading or to the students' ability to read. Within this category, two different themes were recognized (See Table 7). In 60% of the reading related issues, there was a *request for help or assistance* with a task that was within the ability level of the student, but required guidance. Examples of this include students requesting help to spell a word in one of the writing activities, or the request for helping sound out a word in order to read the word. In the other 40% of the reading related issues, a student was identified as *attempting a level or task that is too difficult* and needed to be switched out of their current task into a lower level or less difficult activity. This occurred when a student was attempting to play an activity which required them to read or spell words that were beyond their ability level. Of the five documented reading related issues, 100% were categorized as resolved within the instructional session.

Other. A total of four issues or requests for support were documented that did not fall into any of the above categories. Within this category (See Table 8), three of the four support requests dealt with the *teacher not feeling comfortable leading the ABRACADABRA lesson* with the class and relying on the support of the just-in-time staff that was present in the classroom to provide instruction to the students. The remaining request dealt with *accidental navigation* where a student clicked on an incorrect area which caused them to unintentionally exit out of the software program. Of the four support requests in the other category, 100% were identified as being resolved within the instructional session.

In order to assess the changes in support requests over time, the number and type of requests made during the first two sessions in each classroom was compared with the number and type of requests made during the last two sessions observed in each classroom. Changes in the number of requests presented over time are presented in Figure 4. Among the first two observed sessions, there were a total of 72 issues or requests for support, compared to 20 recorded issues or support requests in the final two sessions observed across the classrooms. Consistent with expectations, the greatest need for just-in-time support was required at the onset of the integration of the new technology, with requests declining over time, most likely as a function of teachers and students becoming more familiar and developing a greater level of comfort with the technology.

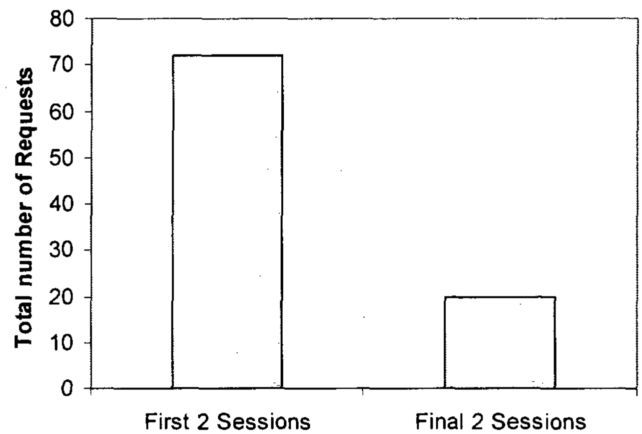

Figure 4. Changes in the number of support requests over time.

When assessing possible patterns in the types of support requested over time, there were no apparent differences. Within the first two sessions observed across the classrooms, over half (51%) of the requests were software related, 35% were hardware related, 8% concerned classroom management issues, and both reading related issues and "other" issues each accounted for 3% of the requests recorded. When looking at the types of requests that were recorded in the final two sessions observed, once again half (50%) pertained to the computer software, 40% were related to the hardware, 10% of the issues were related to classroom management, and no requests were documented that were classified as reading related or "other." While there is an apparent difference in the number of issues or requests for support that were observed across the beginning and end of the implementation of the software, the types of support that were requested remained relatively consistent over time with the majority of requests relating to computer software and hardware issues.

Teacher Outcomes

Items on the Teacher Background Questionnaire were explored in order to compare the experiences of just-in-time teachers before and after receiving the intensive support as well as comparing the experiences of the just-in-time teachers to the minimal support only control teachers after implementing the software program within their classrooms. These comparisons were exploratory in nature given the small number of teachers in both the just-in-time condition (n = 10) and the minimal support only condition (n = 12). The findings obtained from the teacher questionnaire supplied descriptive data about the teachers and their experiences with computers, however, any differences found cannot be generalized to a larger population of teachers due to the small sample in this study.

Computer Use. Prior to the intervention, teachers in the just-in-time support condition reported spending an average of 258.33 minutes (SD = 229.43) per week on their home computer for both personal and school related tasks and an average of 132.50 minutes (SD = 185.62) on their school computers for these same types of tasks. Although fewer minutes of use were reported for school (M=81.94 minutes, SD = 44.40) and home (M = 221.11 minutes, SD = 151.94) use following the intervention, these decreases were not significant ($t(8) = -.82$, $p = .435$ and $t(8) = -.71$, $p = .499$ for school and home use, respectively). There were also no significant differences in computer use reported by teachers receiving the just-in-time instruction and those in the minimal support only condition (home computers use $M = 206.25$, SD = 120.70 and school computer use $M = 106.25$, SD = 88.27) after the intervention (See Table 9).

Teachers' level of comfort with computers was assessed by asking teachers their comfort level surrounding *computer use in general*, as well as their comfort level surrounding *computer use in the classroom*. Prior to the just-in-time instruction, teachers in the just-in-time condition reported a moderate level of comfort with computers in general with 42% reporting feeling *very comfortable* using computers, 8% reporting feeling *comfortable*, 17% reporting *neutral*, 33% feeling *uncomfortable* with computer use and no teachers reporting feeling *very uncomfortable* with computer use in general (See Table 10). In addition, prior to the introduction of ABRACADABRA with the just-in-time support, 17% reported feeling *very comfortable* using computers in the classroom, an additional 17% reporting feeling *comfortable*, 33% reporting a *neutral* level of comfort, a quarter (25%) claimed to feel *uncomfortable* using computers in the classroom, and 8% reported feeling *very uncomfortable* using computers in the classroom (See Table 11). The two variables which assessed comfort with computers in general and in the classroom prior to the intervention and after the intervention were found to be significantly correlated ($r = .87$, $p = .001$ and $r = .73$, $p < .001$ for pre- and post-intervention, respectively) indicating that comfort with computers in general was positively associated with comfort surrounding the use of computers in the classroom.

There were no significant differences found in the just-in-time teachers' comfort with computers in general before and after the intervention, $t(8) = 0.00$, $p = 1.0$, ($M =$ 2.56, SD = 1.33 and $M = 2.56$, SD = 1.42, respectively), or just-in-time teachers' comfort with computer use in the classroom before and after using the program, $t(8) = -1.41$, $p =$ .195, ($M = 2.78$, SD = 1.20 and $M = 2.44$, SD = 1.01, respectively). In addition, no significant differences were found when comparing the post-survey results of teachers who had received just-in-time support and those in the minimal support only control condition with regards to self-reported comfort level surrounding computer use in general, $t(19) = -.57$, $p = .578$, ($M = 2.56$, SD = 1.42 and $M = 2.25$, SD = 1.05, respectively), and computer use in the classroom, $t(19) = -.65$, $p = .524$, ($M = 2.44$, SD = 1.01 and $M = 2.16$, SD = .94, respectively).

When asked about computer access in various areas of the teachers' schools, most teachers (95%) reporting having access to computers in their classroom, 76% had access to computers in a lab in their school, 71% were able to access computers in a library or resource centre in their school, only 10% had access to computers in a pod area within the school, and slightly more than half (52%) were able to access computers in their school staff room (See Table 12).

Integration. Computer integration was comprised of a composite of nine items. The mean integration scores of those teachers who had received just-in-time support did not increase significantly from the onset of the intervention ($M = 2.38$, SD = .94) to the end of the intervention ($M = 2.47$, SD = .83), $t(8) = .51$, $p = .624$. In addition, post-intervention integration for the teachers who received just-in-time support ($M = 2.47$, SD $= .83$) did not differ from the minimal support only control group of teachers ($M = 2.39$, SD $= .69$), $t(19) = .242$, $p = .811$. Both the just-in-time and minimal support teachers reported a moderate level of computer integration (See Table 13).

Views on Computers. Teachers were asked to indicate their level of agreement for 27 items assessing four factors related to views about computers: Computers as an instructional tool; positive computer experiences; technical issues; and computers as a motivational tool. Pre- and post-test comparisons of teachers who received the just-in-time support did not yield significant differences for views on computers as an instructional tool, $t(8) = .58$, $p = .578$; positive experiences with computers, $t(8) = .81$, $p = .442$; technical issues, $t(8) = 1.36$, $p = .221$; or views on computers as a motivational tool, $t(8) = 0.00$, $p = 1.000$.

Post intervention comparisons of the just-in-time teachers to the minimal support only teachers were not significant for any of the four factors, largest $t(19) = .68$, $p = .508$ for technical issues, indicating that computer views did not significantly differ as a function of whether or not just-in-time support was provided throughout the implementation of the software program (See Table 14).

Views Regarding the ABRACADABRA Software. Overall, teachers in both the just-in-time and minimal support only conditions reported a fairly positive view of the program ($M = 3.73$, SD $= .95$). An additional item asked teachers to rate how effective their training was in preparing them for using the software with their classes, using a 5-point Likert-type scale (1 - *strongly disagree* to 5 - *strongly agree*). The greatest number of teachers (33%) answered *disagree*, an equal number of teacher answered *strongly* *agree* (29%) and *agree* (29%), and an equal number of teachers responses *neutral* (5%) and *strongly disagree* (5%). These results indicate that teachers' views varied in how effective they felt the training session was in preparing them to implement the software within their class. While the majority felt that the training was sufficient, a third of the teachers held quite negative views of the training sessions and what they were able to learn from it.

In order to determine whether the instructional software was viewed more or less positively when followed by just-in-time instruction, the views of teachers in the just-in-time instruction group were compared with those in the minimal support only control condition. Surprisingly, teachers who received just-in-time support held slightly less positive views of the software program ($M = 3.61$, SD = 1.26) compared to the minimal support only teachers ($M = 3.82$, SD = .68), although this difference was not found to be significant, $t(19) = -.49$, $p = .631$. In addition, teachers who had received just-in-time support held slightly more positive views of the initial training they had received ($M = 3.88$, SD = 1.17) compared to those in the minimal support only condition ($M = 3.08$, SD = 1.44), however this difference was not significant, $t(19) = 1.37$, $p = .187$.

Views on the Helpfulness of the Available Support. An overall view of the helpfulness of the available support was comprised of three items. Both the just-in-time support and minimal support only control group of teachers responded to these items. Overall, teachers shared a moderately positive view of the available support ($M = 3.33$, SD = 1.26). Not surprisingly, in comparison to the minimal support teachers ($M = 2.50$, SD = .88), the teachers who received the just-in-time support reported more positive views surrounding the support that was available ($M = 3.75$, SD = 1.26), although the difference was not found significant, $t(10) = 1.76$, $p = .108$.

Finally, the just-in-time teachers were asked to respond to an open-ended question asking what source of help they would have turned to had the just-in-time instruction not been provided. The most common source reported by teachers whom they would have turned to was a colleague or fellow teacher using the software program (43%). Another commonly reported possible source of assistance would be a teacher resource manual as well as the teacher support component on the website provided by the makers of the software program (21%). Some teachers reported that they would find a way to resolve issues on their own (14%), while others would turn to the help of an assigned technical support member within the school or the school board (14%). Finally, one teacher reported that she would have exited the program all together and had their class work on another activity (7%).

Student Outcomes

Students' reading gains were assessed using a 2 (time of testing: pre vs. post) X 2 (ABRACADABRA condition: experimental vs. control) Repeated Measures ANOVA for each of the reading measures. The within subjects factor was pre- and post-test performance on each measure. The between subjects factor was condition (no exposure versus exposure to ABRACADABRA).

Letter Sound Knowledge. Students were assigned a raw score out of 26 based on the number of letter sounds they were able to correctly identify at the time of testing (See Table 15). Students showed significant improvement in their letter sound knowledge between the time of pre-and post-test assessment, $F(1, 293) = 108.94$, $p < .001$. There was also a significant main effect for condition, $F(1, 293) = 4.76, p = .03$, indicating that those in the ABRACADABRA condition outperformed those in the control condition. The time by condition interaction was not significant, $F(1, 293) = 0.01, p = 0.91$.

Fry's Word List. Students were assigned a raw score out of 20 based on the number of vocabulary sight words they were able to read aloud correctly when presented to them (See Table 16). Students showed significant gains in their ability to read sight words between the time of pre- and post-testing, $F(1, 293) = 224.57, p < .001$. There was also a significant main effect for condition, $F(1, 293) = 6.72, p = .01$, such that those in the ABRACADABRA condition exhibited greater gains than those in the control condition. These main effects were qualified by a significant time by condition interaction effect, $F(1, 293) = 23.57, p < .001$, indicating that those in the ABRACADABRA condition performed especially well at the time of post-testing.

Auditory Blending. Students were assigned a raw score out of 20 based on the number of trials answered correctly (See Table 17). There was a significant main effect for time of testing, $F(1, 292) = 45.43, p < .001$, indicating that students significantly improved in their ability to blend phonemes into whole words between the time of pre- and post-testing. There was no significant main effect for condition, $F(1, 292) = 1.00, p = .32$. There was however a significant time by condition interaction, $F(1, 292) = 19.75, p < .001$, suggesting that students in the ABRACADABRA condition showed greater improvements in their blending ability at the time of post-testing than those in the control condition.

Taken together, the student outcome measures indicate that students exhibited gains in their reading skill performance over time and that students exposed to the

ABRACADABRA software showed some reading skill advantages relative to children receiving only traditional instruction without the reading software. The most notable achievement gains for students exposed to the software were in the areas of sight word reading and sound blending, which are skills that are less likely to have been taught on a frequent basis in the regular literacy curriculum. Letter sound knowledge, however, is likely more commonly taught in all classrooms at this level, which consequently might account for the limited variability between students who were exposed to the software program, and those who were provided with traditional literacy instruction only.

Student Perceptions Measure. A total of 181 students who had been exposed to the ABRACADABRA software program completed the student perceptions measure. Among those, the majority (67%) indicated that they were *very happy* with the ABRACADABRA program. Slightly less than a quarter (22%) indicated that they were *somewhat happy* with the program, while 5% reported feeling *neutral* about ABRACADABRA. A total of 3% of students indicated feeling *somewhat unhappy* with the software program, while the remaining 3% reported feeling *very unhappy* with the program (See Table 18). These results suggest that the majority of students enjoyed using the program and viewed it in a positive light (See Figure 5).

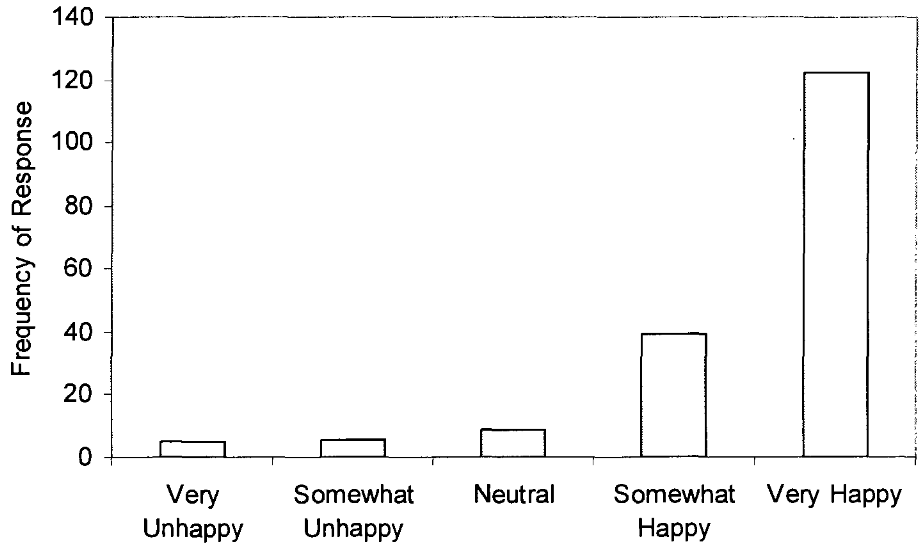

Figure 5. Children's self-reported feelings about the ABRACADABRA program.

When asked about how often the students felt that they played on ABRACADABRA, 48% reported playing *a lot of the time* while 21% indicated that they played *often*. Nearly a quarter of students suggested that they played *sometimes* (23%), while the remaining students reported using ABRACADABRA *not very often* or *never* (7% and 1%, respectively; See Table 19), indicating that overall, students perceived receiving instruction with the reading software as a relatively frequent part of their curriculum.

Discussion

This study explored the impact of just-in-time instructional support delivered to teachers who were implementing a reading software program within their classes for the first time. While previous research has employed self-report methodologies to identify barriers which teachers experience when attempting to integrate computers, the current study used direct observations of instructional sessions in which a new technology was being introduced. Classroom observations and explicit records of requests for assistance were supplemented with self-reports from teachers to further examine their experiences with technology. In addition, the impact of the software on students' learning was assessed in order to ensure that teachers' reluctance to integrate was not due to a negative impact on students' learning. A summary of outcomes is provided below.

Description of the Instructional Sessions which Incorporated the Reading Software

Overall, the observed instructional sessions in which the reading software was in use most often involved the full class utilizing the software at one time (80% of sessions) and typically lasted one classroom period, that is, approximately half an hour of instruction. This time interval was slightly shorter than the original outline which was given as a suggested guide for the use of the software and which has been used in the past when researchers have implemented the software (Comaskey & Deleveaux, 2007; Deleveaux & Simmons, 2008). However, there was a great deal of variability in the amount of time the software was used among the group of teachers in the present study, with observed sessions ranging from 14 to 90 minutes in length (M = 35 min.). While some teachers opted for extended sessions lasting longer than the prescribed 45 minutes of computer time, others chose to implement the software for shorter time periods.

Upon exploration of how the software was used within the classrooms, it became clear that teachers most often focused on the alphabetics activities which targeted pre-reading skills. Reading was also a common focus among the observed sessions, whereas activities targeting comprehension and writing skills were less commonly implemented. These findings were somewhat surprising as they differed from the original guideline that was provided to teachers which suggested a one hour lesson broken up into ten minutes of alphabetics activities, 15 minutes of reading fluency and comprehension activities, 20 minutes of collaborative work which combines all four areas of the program, and 15 minutes of extension work which may or may not involve the use of the technology (Comaskey & Deleveaux, 2007; Deleveaux & Simmons, 2008).

Although the recommended usage structure provided during the initial workshop was not followed, it is likely that the degree to which teachers focused on each area of the program reflected the number of activities available within the four main areas of the program. That is, there were many more units dedicated to precursor and early skills. It is also likely that the use of the various activities reflected the skill level of the students at the various points throughout the intervention period. The teachers may have found it necessary to initially focus on emergent literacy skills (Lonigan, 2006; Whitehurst & Lonigan, 1998) rather than more advanced skills. Whitehurst and Lonigan (1998) argue that these emergent literacy skills are comprised of two types of skill sets, namely inside-out skills and outside-in skills. Inside-out skills refer to basic phonological awareness, such as letter sound knowledge while outside-in skills such as language and conceptual knowledge demand a deeper level of understanding (Whitehurst & Lonigan, 1998). Whitehurst and Lonigan also argue that these skills are more or less influential at different points in time during reading acquisition. While the simple act of decoding is important for the earliest reader, other semantic, syntactic, and more difficult abilities assume greater importance later in the sequence of learning to read (Whitehurst & Lonigan, 1998). Given the ages of the children involved in this study (from junior kindergarten to grade two), it is understandable that a greater focus would be given to earlier or precursor skills. Over the course of the intervention, there was a progression in the types of activities that were used and the areas of reading in which teachers focused on. Specifically, results indicated that lessons started out focusing mainly on basic level skills in the alphabetics area, but by the final sessions, students were utilizing many more of the activities in the more complex areas of the program, such as comprehension and writing.

The observations of the instructional sessions also allowed for the comparison of how teachers used the software within their classroom as an instructional tool. Whereas some teachers opted to integrate the software in a way that involved very structured and planned lessons (47%), others treated it more as a game and allowed the students to play freely within the various activities (39%). It was important that this element of the study remain flexible. While teachers were provided with suggested lesson outlines, it was expected that they knew their students and what was best for them, and was therefore important that they were able to choose to implement the software as they felt was best suited for their classroom.

Results indicated that the fidelity of instruction and the level of engagement that the students exhibited were positively related. It is possible that the software is more effective for students when teachers incorporate planned and structured lessons. Alternatively, when students are more engaged with the software, this may motivate the teacher to develop more elaborate and structured lessons for the students. In the majority of the observed sessions, students were very involved with the software and appeared to be quite engaged and on-task (70%). In less than a quarter of the sessions, students were sometimes unengaged and off-task, however generally speaking, students were most often very excited to be using the software and working on the computers. The use of computers for the literacy instruction of the students offered a nice complement to their traditional instruction and provided students with something new and fresh which they most often looked forward to.

Just-In-Time Support

The primary goal of this study was to assess the various types of challenges that teachers face when integrating technology as well as the kinds of supports that are required for teachers to be able to effectively implement a new technology within their classroom. By mapping out the types of issues and requests for support, it was possible to gain an understanding of the most commonly occurring issues that teachers have to deal with which may be preventing them from integrating computers on a regular basis. Initial research, investigating barriers to computer integration in the classroom, painted a clear picture that technical issues served as a primary concern for teachers and that these concerns were sufficient to prohibit or moderate computer use in the classroom (Wood et al., 2005). More recent research, however, has suggested that increased familiarity and use of computers in general has shifted the concerns from technical limitations to more personal concerns related to pedagogical, attitudinal and other individual characteristics that might inhibit teachers differentially in their ability to integrate computers as part of their instruction (Mueller et al., 2008). While previous research conducted in this area has relied on self-report accounts from teachers (Mueller et al., 2008; Wood et al., 2005), the current study was able to capture actual classroom occurrences through direct observation. Observational results clearly indicate that technical issues continue to be a barrier for teachers. In particular, "software" challenges were the most commonly occurring issues which yielded a request for support. Although this finding is consistent with previous research regarding technical issues, the current study clarified the specific types of software challenges that were likely to pose problems. The most common software related issues dealt with navigation within the software, or glitches and malfunctions of the software program that needed to be addressed.

The most effective way to overcome these types of issues is with the presence of on-site technical support. The presence of software glitches and malfunctions are almost inevitable when using most types of software, so there is little that can be done to prevent these occurrences entirely. It would be beneficial for the educators and software developers to work collaboratively in order to resolve commonly occurring problems with the software and any other problems that the educators might have surrounding the software program and the way it functions. In the mean time, a promising solution that will allow teachers to feel more confident when using the technology is the presence of support that is available when issues arise. It is possible that more extensive training could also have provided teachers with a greater understanding of how to fully navigate the software and troubleshoot when technical glitches arose. Unfortunately, these issues can not be predetermined, which makes it nearly impossible to design a training session that is able to fully cover the myriad of potential software issues that could arise in the classroom.

Indeed, support for these types of problems was readily provided by having access to just-in-time instructional support on hand. However, it is also important to note that for 23% of the issues that arose, resolutions could not be made immediately or during the planned session. In these cases, the support staff was able to act as a liaison who could communicate the unresolved issues with the software developers who could later provide a solution to the problem. Thus, even with immediate, on-site support there will be occurrences that cannot be resolved. Teachers need to be aware of these challenges and they need to have alternatives or back-up plans to accommodate these situations.

The "hardware" category also fits under the traditionally identified barrier of technical challenges. However, the vast majority of problems encountered with hardware in the present study did not involve the computer per se, but rather the peripherals used to support the use of technology in the classroom. Specifically, many requests for help involved problems with the headphones used by individual students in order to maintain a quieter more focused learning environment. A lack of headphones, which was often reported as unresolved, presents a resource challenge for many teachers. Many schools do not have the necessary number of headphones available for each student to have their own individual pair. In some cases, this issue was eventually resolved by sending a letter home which asked parents to send a set of headphones in to school with their child. Headphones were then kept in the classroom, and each student then had their own individual pair for use when computers were being utilized.

In addition, problems commonly arose surrounding the use of the computer mouse. This often resulted from the students' lack of experience using the mouse, and consequently they would often require assistance with tasks such as double clicking and re-positioning the mouse. Providing an introductory session for the students which introduced them to the hardware and its components may have helped to circumvent this issue. When the computer itself was the concern, the greatest challenges involved the settings, typically involving the screen size or the settings on the desktop of the computer. These types of issues are sporadic and difficult to anticipate, and for this reason, they are best resolved through the presence of on-site support that can re-adjust the settings, as necessary.

Fewer observed issues dealt with classroom management or the behaviour of the students in the classroom (11%). Within this category, issues most often related to students not following the instruction of the teacher by choosing to play on an inappropriate activity, or playing inappropriately within the desired activity. In this case, the on-site support acted as an aid for the teacher in ensuring that all of the students were on the right track and in the desired activity. It can be overwhelming for teachers to keep track of an entire classroom of students on individual computers, so there is a definite demand for extra support that can circulate and assist the teacher in this respect.

Results showed that few requests surrounded reading related issues, or "other" issues which could not be classified as software, hardware, classroom management, or reading related issues. Within the reading related issues, support was required when students needed assistance with the task at hand, or needed to be moved to a different task that was more in line with their ability level. These issues sometimes occurred as a result of students entering into activities that were too difficult for them. When the teacher did not recognize that this was happening, the just-in-time support was able to alleviate the problem by assisting the students in finding another, more appropriate activity. In order to prevent this issue, teachers would need to specifically assign activities to students based on their ability level. For example, in some classrooms, teachers designed a seating plan and would physically group the class based on their ability level and the skills that the teacher wanted each student to work on. This then made it easier for the teacher to assign specific activities to certain groups of students within the class and better allowed the teacher to monitor the students to ensure that they were working in the correct activity. This requires a greater level of planning and instruction from the teacher, but it is possible that it might also result in a greater level of student engagement and knowledge gain for the students.

The majority of "other" issues surrounded one teacher in particular who relied on the just-in-time support staff to lead the first three initial lessons with the students. The teacher indicated that she did not feel confident enough with the software to lead the lessons independently for each of these sessions. Over time this teacher was given explicit and direct instruction regarding activities that would be appropriate as well as instruction on how to access the activities and how to direct students to the activities. She was then able to lead the fourth session. The issue of developing or providing "ideal" training presents a difficult challenge because teachers training needs varied considerably. In addition, teachers responded to the training session differently. A more in depth training which is tailored to the specific needs of the different teachers may be required to ensure successful preparation to initiate the reading program, however, the practicality of devising such supports seems unlikely given the resources that would be required. In this particular case, having the just-in-time support there to aid the teacher in instruction for the first few initial lessons was the best way to overcome this challenge. After three sessions in which the just-in-time support modeled the use of the software within the classroom, the teacher was able to construct and deliver her lessons independently. It also became quite apparent that her ability to integrate the program and her confidence when using the program in her classroom increased substantially throughout the intervention period. Indeed, all of the issues within the reading and "other" categories were able to be resolved with the assistance of the on-site, just-in-time support.

An additional focus of the current study was to track requests for support over time to see if there were any apparent changes in the types of support that were requested throughout the sessions. Analysis of the types of support requested in the initial sessions versus the final sessions indicated that there were no apparent differences in the types of support requested over time. Computer software and hardware related requests remained the most common when looking at the patterns of support requested over the duration of the intervention. What did change, however, were the number of observed issues/requests for support over time. As expected, there were over three and a half times as many requests for assistance made in the initial two sessions compared with the final two sessions. This result is consistent with that of van Merrienboer et al. (2002) who suggested that just-in-time instruction is especially beneficial during the initial stages of learning, but becomes less important later on, once learners have gained more expertise in the required domain.

One of the most interesting findings was that among the documented requests for support, 94% occurred during the instructional sessions, at the time that the software was being used. Only 6% of the support requests were presented to the just-in-time staff before or after the instructional sessions, and all of these requests pertained to computer software or hardware. This finding further supports the need for support that is on-site and available when teachers need it. Consistent with Granger et al. (2002), results suggest that potential issues and necessary support cannot be anticipated by teachers, and the majority of problems or questions are likely to arise during instruction. In such events, teachers are sometimes able to rely on the support of peers or fellow teachers, or alternatively a designated ICT support person within the school. When these individuals are familiar with the software being used, issues may be able to be resolved within a timely manner. Unfortunately, access to these individuals and their level of knowledge surrounding the software in use is uncertain, which is where consistent, on-site support is the most beneficial solution. Without the presence of on-site support, it is possible that these unanticipated issues may have gone unresolved which would have resulted in the interruption of the intended lesson. While it would be ideal for teachers to have access to just-in-time support on a regular basis when computers are being used in the classroom, it does not go unrecognized that this may not be the most feasible solution. Perhaps a more realistic approach would be to provide more extensive training to designated individuals within the schools who could act as a peer expert who teachers could turn to for assistance when technical issues arise in the classroom.

A great deal of the observed issues required someone on-site who was familiar with the software program and could troubleshoot when required. Other issues more simply required additional support for the teachers, as it can be overwhelming for them when initially trying to use computers with students at the primary level. Students' computer experience can vary quite drastically at such a young age, and it was clear that while some students were able to navigate independently, others required a great deal of help with the simplest of tasks. Even tasks such as logging in, and getting into the desired activities could be daunting for teachers without extra support on hand to help those students with limited computer experience.

Teacher Outcomes

Self-reports from teachers were important in understanding their own personal attitudes and experiences surrounding computers. Surveys were collected from teachers in the just-in-time condition before and after the intervention took place and surveys were collected from the minimal support only control condition only after the intervention took place. This allowed for a comparison of just-in-time teachers' attitudes and experiences before and after receiving the support, as well as the comparison of those attitudes and experiences of teachers who had and had not received the intensive just-in-time support, although these comparisons were highly exploratory considering the small sample of teachers in both the just-in-time (n = 10) and minimal support only control (n = 12) conditions.

Comparisons made between the teachers who received just-in-time support versus the minimal support only teachers did not yield significant results, indicating that just-in-time support compared to minimal support only did not significantly alter teachers' reported attitudes and experiences with computers. Given the small sample size in the present study, it is possible that potential differences could not be detected, and the results from this study cannot be generalized to a larger population of teachers. Although it was expected that there might be some differences between the groups of teachers who did and did not receive just-in-time support, it is not entirely surprising that differences for these general attitudes and uses of computers did not differ significantly as just-in-time instruction was specific to the one instructional setting involving the ABRACADABRA reading software.

When assessing reports from only those teachers who had been exposed to the just-in-time instruction, self reported computer use, comfort level surrounding computer use, teachers' reported level of integration, and views toward computers did not significantly differ from the onset to the conclusion of the intervention. Once again, the small number of teachers in the sample may have prevented significant findings in this case. It is also possible that the frequency and duration of the just-in-time support provided in this study was not enough to alter the computer views and experiences of teachers who had received the support. Just-in-time support was provided exclusively alongside the use of the ABRACADABRA software program, which left teachers without the support when other computer programs may have been in use. It is possible that the issues that may have arisen during computer use outside of the use of ABRACADABRA could have impacted the responses to these measures because the measures assessed general views rather then views specific to the reading software program.

Overall, teachers in both the just-in-time and minimal support conditions reported positive views of the ABRACADABRA software, which may have been a reflection of the gains they witnessed in the knowledge and skills of their students following the use of the program. Although teachers reported positive views of the software program itself, a third of teachers (33%) felt that the initial training they had received was not effective in preparing them to use the software within their classes. Clearly, there are individual differences in teachers' skills and training requirements that need to be considered prior to implementing computer-based interventions. The one-size fits all approach to the workshop was inconsistent with the just-in-time intervention, suggesting that a more effective intervention might have included a pre-intervention sampling of teachers' needs and requirements followed by a more individualized instructional training session. Such an intervention would more readily accommodate teachers' needs and prepare them to use the software, although it would likely prove to be quite costly and would demand a great deal of time, which may not make it a feasible solution for some schools.

The design employed in the present study may have been reflected in the just-in-time requests seen in the intervention. However, given the intensive instructional hours that would be required for this type of intervention, the provision of a generic introduction workshop followed by the just-in-time instruction is probably more realistic for natural teaching environments where support from trained peers or other staff during lessons is more likely than a series of individually prepared instructional sessions for the teacher. In addition, the types of requests often reflected unanticipated concerns, which would be hard to incorporate in any intervention workshop. The variability in teachers' views on the effectiveness of the training session further reinforces the need for flexibility in the design of an introductory workshop in order to reflect the differences in teachers and their individual learning styles. Traditional training seminars might suffice for some teachers, but others will require the presence of consistent support that is available when technology is being integrated in their classrooms.

When questioned about what source of help teachers would turn to, had the support staff not been available, a large percentage of teachers (43%) identified their colleagues and fellow teachers as their go-to resource for help. This finding is consistent with the work of Granger et al. (2002) who suggested that teachers most often turn to on-site support, such as peers and fellow teachers within the school when help is needed.

The issue is that fellow teachers may not always be available when technology is in use and help is required, which results in a disruption of the teachers' originally intended lesson. With the presence of just-in-time support that is dedicated to helping teachers' resolve their issues with technology, this disruption could be prevented which is why some form of just-in-time support is necessary in order to effectively facilitate the integration of new technologies in the classroom.

Student Outcomes

It was expected that students would exhibit gains in their scores on the reading measures, and that these gains would be especially apparent for the students who used ABRCADABRA throughout the intervention period. Consistent with research looking at the benefits of instruction which incorporates computers (Abrami et al., 2006; Calvert et al., 2005; Chambers et al., 2001; Christmas & Badgett, 2003; Espinosa et al., 2006; Kulik & Kulik, 1991; McGivern et al., 2007; Naevdal, 2006; Wittwer & Senkbeil. 2007), results of the student assessments indicated that the software program was successful in effectively facilitating student learning. More over, the program appeared to be effective in facilitating the development of skills which may not have been a focus in traditional literacy instruction at this stage without the software. It was important to assess the effectiveness of the software in order to rule out the possibility of ineffective software as a cause for teachers' reluctance to integrate technology in their classrooms.

Additionally, it would seem reasonable that teachers would be reluctant to use computers in their classroom if the students did not enjoy it or did not benefit in their skill development. While the observers' ratings of student engagement were quite high, the students' own self-reported feelings about using ABRACADABRA were also very positive. Among the students who received exposure to ABRACADABRA in their classroom, the majority (67%) indicated that they were very happy when they got to use the program. Students' excitement surrounding the program, taken together with the positive outcomes of the student assessment measures, suggests that the software is a very effective instructional and motivational tool to be used in classrooms. The use of the technology promotes student learning, while providing a fun and entertaining way for the students to gain knowledge and practice new skills. Students are engaged when technology is incorporated into the lessons, which helps them to maintain attention and stay motivated. With this in mind, it becomes imperative that we find the optimal level and appropriate type of support that can be provided to teachers in order to allow them to comfortably integrate technology into their teaching regime.

Contributions of this Research

This study was successful in identifying the issues and types of supports that are required when teachers are attempting to integrate a new technology in their classroom for the first time. The extensive collection of observations that were taken in the classrooms while the software program was in use served as the focus and provided a unique contribution to research in the area of technology integration. Rather than relying solely on self-reports that could be influenced by memory, affect, or other situational variables, this study provided an intensive first-hand look at the types of issues that most commonly arise when computers are being used in the classroom over an extended period of time. Specifically, this study clearly demonstrates that teachers encounter many technical challenges when using software for instruction. These hardware and software issues can, for the most part, be resolved with on-site, just-in-time support. Additionally, the current study showed the importance of mapping specific concerns across many instructional sessions in different classrooms in order to extract "common concerns". Knowing these common concerns will allow for the development of more effective workshops and interventions. In addition, some of these concerns can be shared with software developers in order to refine available software.

The student assessment data provided valuable information regarding the effectiveness of the computer software program as a learning tool. The positive results obtained helped to rule out ineffective software as a barrier which might have limited the teachers' use of the software with their classrooms. Through observation and students' own self-reports, it was possible to gain insight into the students' responses to the software and how much enjoyment they themselves got out of it. The results supported previous research regarding the performance benefits of computer-assisted instruction relative to traditional instruction alone (Abrami et al.,2006; Calvert et al., 2005; Chambers et al., 2001; Christmas & Badgett, 2003; Espinosa et al., 2006; Kulik & Kulik, 1991; McGivern et al., 2007; Naevdal, 2006; Wittwer & Senkbeil. 2007) as well as motivational enhancement for students (Chambers et al., 2001; Cole & Hilliard, 2006; Means & Olson, 1995).

This research is particularly important due to its practical application in the real world context of education. The use of technology and computers in particular is becoming increasingly common in the education system, yet many teachers are still apprehensive to integrate technology in their own classrooms. This research outlines many different barriers faced by teachers and provides insight into why teachers might be so apprehensive when they attempt to use computers within their classrooms.

Limitations and Future Directions

The design of the current study permitted an in-depth, qualitative understanding of the experiences of these teachers, but unfortunately, the small sample made it difficult to compare responses on the more general measures such as the teacher questionnaire, both within the just-in-time group, as well as between the minimal support only control and just-in-time support groups.

Ideally, given the support that the just-in-time intervention was able to provide, this small-scale study should be followed up with a more robust investigation involving a larger cohort of teachers. Such an investigation would require significant resources, both financially and in terms of human resources, however, by training larger groups of teachers, such a study would develop the kinds of experienced peer support that teachers typically rely upon for help when implementing technology in their classrooms. One possible mechanism to circumvent the human resource demands for providing just-in-time support would be to train one group of teachers within each school. Having access to a peer on site would be more feasible in the long run, but would require an extensive amount of initial training in order to ensure that these individuals are knowledgeable enough to address the various concerns that could arise when computers are being used in the school.

Unfortunately, it was not possible to collect pre-intervention questionnaires from the minimal support only teachers. This limited the types of analyses that were possible for the responses on the teacher background questionnaire. In the future, it would be important to assess pre- and post-intervention responses from teachers who receive just-in-time support, those who receive minimal support only, and a control group of teachers who are not implementing the software. This would allow for more control regarding the pre-intervention attitudes and experiences of teachers in each of the conditions.

It would also be important to discriminate between general attitudes toward computers and attitudes toward computers where just-in-time instruction is used in order to assess the impact of the instructional support. In the current study, just-in-time support was available exclusively when the classrooms were working with ABRACADABRA. This left the teachers without just-in-time support during other times in which they may have been using technology in their classroom. Items on the post-intervention teacher questionnaire referred to experiences and attitudes surrounding computer use in general, rather than the specific software program implemented in this study. Because of this, responses provided on the post-intervention teacher questionnaire may have been influenced by whatever technological challenges teachers faced when the just-in-time support was not present in their classroom. For this reason, it would be beneficial to look at the impact of a just-in-time support system that is available to teachers whenever any technology is in use in the classroom. Although this might provide an ideal solution, it also might not be feasible due to the resources that it would require, both in the form of time and money.

An additional limitation of exclusively assessing the presence of just-in-time support alongside the use of ABRACADABRA meant that the sample consisted of only kindergarten, grade one, and grade two teachers, which may have affected teachers' responses to technology. The potential differences are apparent when looking at the challenges observed in the current study and how they vary from those reported by teachers across a variety of grades in both elementary and secondary school in previous research (Mueller et al., 2008). Teachers' responses to technology may change when looking at teachers of a more mature age group whose students are likely more familiar with technology. Student characteristics have been identified as one of the key environmental factors which can either inhibit or encourage teachers' integration of technology in the classroom (Wood et al., 2005). Student familiarity with technology is likely to alter the types of issues and requests for support that come up when just-in-time support is present.

Children's use of computers continues to become more prevalent both in schools and at home. In a study looking at 1,065 households, parents reported that 21% of their children under the age of two had used a computer. This percentage continued to increase with age, with parents reporting that 58% of their 3 to 4 year olds, and 77% of their 5 to 6 year old children had used a computer (Calvert et al., 2005). These figures shed light on just how influential computers can be on the lives of children, as young as two and a half years of age. Future research should assess a larger number teachers, across a range of grades, in order to assess whether these findings would hold true, or alternatively, what types of differences might exist based on the age and previous computer experience of the children in the classroom, and the type of technology being utilized.

Summary

The current study highlighted the types of challenges that teachers faced when implementing a new software program in their classrooms for the first time. Observations indicated that a variety of concerns can arise when computers are being used in the classroom, the majority of which pertain to technical issues such as computer software and computer hardware related concerns. The majority of the issues that occur, however, can be resolved through the presence of just-in-time instructional support that is on-site.

It is understandable why some teachers would rather avoid the integration of computers all together as this presents numerous challenges that could otherwise be avoided by resorting to traditional instruction alone. However, computers provide a different mode of instruction which can be especially motivating for students and can provide learning gains that are greater than those achieved from traditional instruction alone (Abrami et al.,2006; Calvert et al., 2005; Chambers et al., 2001; Christmas & Badgett, 2003; Cole & Hilliard, 2006; Espinosa et al., 2006; Kulik & Kulik, 1991; McGivern et al., 2007; Naevdal, 2006; Wittwer & Senkbeil. 2007). Indeed, students in the present study appeared to be engaged while using the computers and reported very positive attitudes about the software program following the intervention.

The ever increasing popularity of computers coupled with the recognized benefits of computer use in the classroom warrant further exploration into how computer integration can be effectively facilitated within schools. Implications of this research suggest that a consistent and permanent support, possibly in the form of trained peers within the school, may be necessary in order to foster teachers' implementation of computer technology. As the prevalence of computers continues to rise, it is necessary to find supports for those teachers who are still currently reluctant to integrate. While workshops and formal training sessions are important, this study suggests that there are many issues that teachers can not anticipate, which demand the presence of on-site support when technology is being used. By addressing the issue of support, along with the other barriers that teachers face, it will be possible to determine what changes are necessary in order to facilitate the effective integration of technology in classrooms and ease the transition to computer-based learning.

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Table 1

Examples of the Qualitative Explanations for each Category Rating of Fidelity of Instruction

Poor	Adequate	Excellent
-Students not monitored by teacher, therefore did not get help when needed	-Activity choices given ahead of time but not monitored	-Students directed to activities which specifically related to classroom learning
-Students not encouraged to use the program	-Students able to play on any activity/level of their choice while teacher supervised and occasionally helped students, when asked	-Excellent instruction from teacher and a great overall introduction to the program -Had students very involved and participating
-Teacher logged into the program, but then left the students to work independently with no instruction	-Students not directed to specific activities (free choice)	-Teacher had children sit at the front of the class first and have whole class instruction -Very specific instructions given while class was engaged and participating
-Students were not invited, encouraged, or directed to use the program	-Required just-in-time assistance in delivering the lesson on the program to the students	-Teacher used cards and mounted them on board to show which activities and stories each student should work on depending on their ability level
-No directions given -No expectations for students -Random/free play	-Poster hung with cards showing which activities/storied are allowed, but no instruction given other than that	-Lesson well planned with clear expectations for students laid out
-No instruction given at all -Students signed on to program and played on whichever activity they choice -No ability level differentiation	-Given activities to choose from but no formal lesson given to students	-Great lesson plan set out – structured, covered more than one focal area -Teacher stuck to guidelines and students were given expectations

Table 2

Examples of the Qualitative Explanations for each Category Rating of Students' Level of Involvement

Poor	Adequate	Excellent
-Students were not doing the activities properly	-Confusion about selecting stories with activities – some students went into teaching area and then got frustrated/discouraged	-Students very engaged -Listened to instructions well -Played independently on their computers but were directed by teacher as per which activities to go into
-No students chose to use the program for the entire period	-Students did not always seem to be paying attention to activities -It looked like they just liked the graphics	-Students seemed very engaged with the computer and the activities -Very motivated to play the activity (word matching) and to get the correct matches
-Only one student chose to play on program and spent the majority of the time going nowhere	-Students seemed excited/engaged while on program, but after about 20 min. went into other programs	-Students actively participating with the teacher while being introduced to 'tracking' activity -Seemed to enjoy playing the activities and motivated to answer correctly
-No students on the program (by choice)	-Somewhat engaged while on program -Became bored quickly and some chose to play another game after only a couple of min. in program	-Students engaged and worked well on their own with little instruction -Knew how to navigate the program on their own and get into the activities of their choice
	-Students are distracted by other students in the computer room	-Students are engaged and excited to play on the program -Worked quietly and independently and stayed on task
	-Students fairly engaged, but some would tire quickly on an activity and switch to another every few minutes -A few seemed distracted and off-task and a couple logged off before the period was over	-Students were very engaged and highly motivated -Stayed on task -Almost always finished an activity before moving on to the next

Table 3

Summary of the Number and Type of Issues or Requests for Support Recorded in the Observational Notes

Type of Issue or Request for Support	During Instructional Session	Before or After Instructional Session	Total	Percent Total
Software	91	6	97	51.87
Hardware	55	5	60	32.09
Classroom Management	21	0	21	11.23
Reading Related	5	0	5	2.67
Other	4	0	4	2.14
Total	176	11	187	100

Table 4

Summary of the Number and Type of Computer Software Related Issues or Requests for Support

Theme of Observed Issues or Requests for Support	During Instructional Session	Before or After Instructional Session	Total	Percent Total
Navigational Issues	34	0	34	35.05
Software Glitch or Malfunction	22	0	22	22.68
Start-Up or Log-In Help Required	15	0	15	15.46
How to Play Activity	12	1	13	13.40
Frustration with Element of Software	6	1	7	7.22
Internet Browser or Connection	2	1	3	3.09
Bookmarking	0	2	2	2.06
Implementation of ABRACADABRA	0	1	1	1.03
Total	91	6	97	100

Table 5

Summary of the Number and Type of Computer Hardware Related Issues or Requests for Support

Theme of Observed Issues or Requests for Support	During Instructional Session	Before or After Instructional Session	Total	Percent Total
Headphones	18	0	18	30
Mice	12	0	12	20
Adjustment of Computer Set-Up	4	4	8	13.33
Slow Computer Function	6	0	6	10
Computer Frozen or Not Working	4	0	4	6.67
Inability to Network Classroom Computers	4	1	5	8.33
Projector	5	0	5	8.33
Defective Speakers or Computer Sound	2	0	2	3.33
Total	55	5	60	100

Table 6

Summary of the Number and Type of Classroom Management Related Issues or Requests for Support

Theme of Observed Issues or Requests for Support	During Instructional Session	Before or After Instructional Session	Total	Percent Total
On Incorrect Activity within ABRACADABRA	7	0	7	33.33
Incorrect Use/Play within Activity	6	0	6	28.57
Students restless/unengaged	2	0	2	9.52
Move to another Game	2	0	2	9.52
Refusal to Participate	2	0	2	9.52
Issues working in Groups	2	0	2	9.52
Total	21	0	21	100

Table 7

Summary of the Number and Type of Reading Related Issues or Requests for Support

Theme of Observed Issues or Requests for Support	During Instructional Session	Before or After Instructional Session	Total	Percent Total
Request for Assistance with Task	3	0	3	60
Attempting Task that is Beyond Ability Level	2	0	2	40
Total	5	0	5	100

Table 8

Summary of the Number and Type of "Other" Issues or Requests for Support

Theme of Observed Issues or Requests for Support	During Instructional Session	Before or After Instructional Session	Total	Percent Total
Teacher Not Comfortable Leading Lesson	3	0	3	75
Accidental Navigation	1	0	1	25
Total	4	0	4	100

Table 9

Summary of Teachers' Self-Reported Computer Use at Home and at School in Minutes

	Minimal Support		**Just-In-Time Support**	
	M	SD	*M*	SD
Pre Intervention Responses				
Computer Use at Home	N/A	N/A	258.33	229.43
Computer Use at School	N/A	N/A	132.50	185.62
Post Intervention Responses				
Computer Use at Home	206.25	120.70	221.11	151.94
Computer Use at School	106.25	88.27	81.94	44.40

Table 10

Summary of Teachers' Self-Reported Comfort with Computers Use in General

	Minimal Support		**Just-In-Time Support**	
	Pre Intervention Percent	Post Intervention Percent	Pre Intervention Percent	Post Intervention Percent
Very Comfortable	N/A	25.0	41.7	33.3
Comfortable	N/A	41.7	8.3	11.1
Neutral	N/A	16.7	16.7	33.3
Uncomfortable	N/A	16.7	33.3	11.1
Very Uncomfortable	N/A	0	0	11.1

Table 11

Summary of Teachers' Self-Reported Comfort with Computers Use in the Classroom

	Minimal Support		**Just-In-Time Support**	
	Pre Intervention Percent	Post Intervention Percent	Pre Intervention Percent	Post Intervention Percent
Very Comfortable	N/A	25.0	16.7	22.2
Comfortable	N/A	41.7	16.7	22.2
Neutral	N/A	25.0	33.3	44.4
Uncomfortable	N/A	8.3	25.0	11.1
Very Uncomfortable	N/A	0	8.3	0

Table 12

Summary of Teachers' Access to Computers within their Schools

Access Area	**Total Percent with Access**
Classroom	95.2
School Computer Lab	76.2
Library or Resource Centre	71.4
Pod Area	9.5
Staff Room	52.4

Table 13

Summary of Teachers' Degree of Computer Integration Before and After the Intervention

	Minimal Support		**Just-In-Time Support**	
	M	SD	*M*	SD
Pre Intervention Responses	N/A	N/A	2.38	.94
Post Intervention Responses	2.39	.69	2.47	.83

Table 14

Summary of Teachers' Views of Computers

	Minimal Support		Just-In-Time Support	
	M	SD	*M*	SD
Pre Intervention Responses				
Instructional Tool	N/A	N/A	4.05	.65
Positive Experiences	N/A	N/A	3.09	1.13
Technical Issues	N/A	N/A	3.06	.61
Motivational Tool	N/A	N/A	3.85	.96
Post Intervention Responses				
Instructional Tool	3.99	.53	4.11	.41
Positive Experiences	3.45	.33	3.27	.87
Technical Issues	3.14	.70	3.25	.66
Motivational Tool	3.92	.74	3.85	.80

Table 15

Summary of the Pre- and Post-Test Means for Student Letter Sound Knowledge

	Control		**ABRACADABRA**	
	M	SD	*M*	SD
Pretest	17.32	8.14	19.07	7.94
Posttest	20.37	6.68	22.18	6.23

Table 16

Summary of Student Pre- and Post-Test Means for Fry's Instant Word List

	Control		**ABRACADABRA**	
	M	SD	*M*	SD
Pretest	8.07	8.24	9.37	7.35
Posttest	10.20	8.15	13.54	7.37

Table 17

Summary of Student Pre- and Post-Test Means for the CTOPP Blending Task

	Control		**ABRACADABRA**	
	M	SD	*M*	SD
Pretest	8.19	4.19	7.91	4.38
Posttest	8.59	4.31	9.83	4.02

Table 18

Summary of Students' Feelings about the ABRACADABRA Program

	Total Percent
Very Happy	67.4
Somewhat Happy	21.5
Neutral	5.0
Somewhat Unhappy	3.3
Very Unhappy	2.8

Table 19

Summary of Students' Perception of Use of the ABRACADABRA Program

	Total Percent
A Lot of the Time	47.5
Often	21.5
Sometimes	23.2
Not Very Often	7.2
Never	0.6

Appendix A

Dear Parent,

The Grade One students at [School Name] have the opportunity to use a new reading program this year called ABRACADABRA. It is a computer program that teachers can use to help young children learn about letters, sounds, words and sentences. The teacher will use this new program *and* the reading program that is normally used in the classroom. All of the children in your child's classroom will be using ABRACADABRA. The program will be used about 2 times a week for an hour. Children will use the program in small groups or as a whole class when the program is used.

Until now, the ABRACADABRA program has only been taught by researchers. Dr. Eileen Wood and Alissa Anderson at Wilfrid Laurier University (in Waterloo) and researchers at the Center for the Study of Learning and Performance (in Montreal) will be working with your child's teacher to see if this computer program is useful for teachers.

To find out if the program is helping children to learn how to read, researchers need to know how much children know before they start using the program and how much they know after using the program. We are writing to ask if we can test your child before the program starts, and after it is finished. We will ask your children some questions about letters, words, and numbers. These tests are only going to be used to see if the ABRACADABRA program works. Your child's answers will only be seen by researchers. All information will be stored at Wilfrid Laurier University.

Your child's participation is completely voluntary and you may withdraw your child at any time. This project has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University and McGill University. This proposal has also been reviewed by the School Board's Ethics Review Committee.

If you have questions, or want to know more, please feel free to contact Dr. Eileen Wood in the Department of Psychology at Wilfrid Laurier University 519-884-1970 ext. 3738. If you have any concerns about his project, contact Dr. Bill Marr, Chair, University Research Ethics Board, Wilfrid Laurier University, (519) 884-0710, extension 2468.

Please answer the questions on the next page and return the form to your child's classroom teacher by Tuesday November 27 in order to participate in this early literacy study.

Thank you,

Eileen Wood, Ph.D. Alissa Anderson, B.A.

If you **agree** to let your child participate in the ABRACADABRA study please fill in the following information.

Print Child's Full Name: ____

Print Teachers Name: ____

Name of Parent/Guardian (please print)

____

Parent/Guardian Signature: __________________________ Date: __________

If you **do not** want your child to participate, please fill in the information below:

Print Child's Full Name: ____

Print teachers Name: ____

Name of Parent/Guardian (please print)

____

Parent Signature: ____________________________ Date: ________________

Appendix B

University letterhead

Dear Teacher,

The Center for the Study of Learning and Performance (CSLP) in partnership with researchers Dr. Eileen Wood and Alissa Anderson at Wilfrid Laurier University have embarked on an exciting reading intervention project called ABRACADABRA. ABRACADABRA (ABRA) is an evidence-based, balanced reading software program. This software program has undergone extensive empirical evaluations with excellent results for developing reading skills. The purpose of the current research is to place this tool in the hands of teachers. The software will provide another way to support children in their developing reading and spelling skills. We are hoping to introduce this software in your classroom.

How will this program work in the classroom?

Each teacher will attend one training workshop during regular school hours (a replacement teacher will be provided for the classroom). The workshop will provide hands-on instruction with the software and the pedagogy behind the software. ABRA contains a Professional Development Module (how to use and support the program), an Assessment Module, and a Parent Module. Instruction will centre on the software and the professional development module. Teachers will use the software, in addition to their own ongoing literacy instruction, for approximately 1 hour, 2 times a week for a total of approximately 24 hours. The software can be used with individual children but ideally it will be used in a whole class to small group format.

The researchers will arrange for an expert with computers and this software to be on site when you use the program in case you need any assistance in troubleshooting with the technology. The expert can also provide information about the software, if you want information. The expert is simply there as a resource. Our past experience suggests that having access to instruction and help just when a problem arises is the ideal way to introduce any new technology in the classroom. Our expert will be there to provide that just-in-time instruction but will not interfere in any way if not asked to do so. We are hoping to video-tape one or more ABRA session(s). These video-tapes will coded so that we can understand how the program is being implemented (for example, we will measure what components were used during the session, for how long, how many children). At the beginning and end of the study, each teacher will be asked to fill out a short survey regarding computer experience. At the end of the study, each teacher also will be invited to participate in a short one-on-one interview to find out more about their experiences with this software. This interview will take approximately 15 minutes.

Students in each classroom will be tested prior to the introduction of the ABRA program and after the study is complete. What about Confidentiality?

All information that is collected in this study is confidential so names are not associated with the information. Each teacher and student will be assigned a code. Any information collected, will only be referred to by this code. When information is transferred from notes to an electronic file, no identifying information will be available on the file. Research presentations and academic publications about this study will not contain any personal or identifying information about those who participate. Only group averages will be presented. All data will be stored in a locked lab room at Laurier for about 5 years at which point it will be destroyed. Access to this lab room is restricted to research personnel and graduate students, all of whom have been trained in the ethical conduct of research.

Participation in this study is completely voluntary. Individuals, teachers and students are free to decline participation in this study at any point without any negative consequences to them, their classroom or their school. The ABRA program is offered free to all participants and will remain accessible even if participants decline their participation.

Who has reviewed this project?

This project has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University and McGill University. This proposal has also been reviewed by the Board's Ethics Review Committee and this research has been authorized as acceptable.

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. Bill Marr, Chair, University Research Ethics Board, Wilfrid Laurier University, (519) 884-0710, extension 2468.

If you have questions at any time about the study or the procedures, (or you experience any problems as a result of participating in this study) please feel free to contact the researcher, Dr. Eileen Wood in the Department of Psychology at Wilfrid Laurier University 519-884-1970 ext. 3738.

We hope you will be willing to participate in this exciting research. If you are willing, please sign the attached consent form.

Sincerely,

Eileen Wood, Ph.D. Alissa Anderson, B.A.

Consent Form:

- ☐ I have read the above statement outlining the study about ABRACADABRA being conducted by Dr. Eileen Wood and Alissa Anderson at Wilfrid Laurier University and give my consent to participate in this research project

Name (Print) ______________________________

Signature ________________________________

Date ____________________________________

CONSENT for Video Footage to be used for Professional Development

As part of the data collection for the study we would like to video-tape one or more sessions where ABRA is used. These video-tapes, as mentioned above, will allow us to code the sessions for what parts of ABRA are used, for how long a segment is used etc... These tapes will be destroyed immediately after the information is coded. In some cases we would like to be able to use some footage for professional development sessions. Part of the mandate in developing the ABRA program is involve educators in the development process and to use exemplary demonstrations by educators as teaching material for novice users. If you are willing, some video footage may be used for demonstration of the ABRACADABRA software. Your name and school would never be released in any of these presentations.

Consent for our use of video footage for professional development is NOT necessary to be part of this study.

I agree to allow the researchers to collect some video footage to be used only for coding

YES ☐

NO ☐

I agree to allow the researchers to collect video footage for coding and if warranted for use as professional development material

YES ☐

NO ☐

Name: ____

Signature: ___________________________ Date: ______________

We expect that data collection will be quite lengthy but we would also like to provide an opportunity to share our findings with you. After the study is complete, we will send a summary of our findings to each participating teacher. If you request below, we will also send you copies of the manuscript we will prepare for publication.

Yes ___ I would like a copy of the manuscript. Please send it to

____

____

____

____

Appendix C

ID Code: ______

Your Name: ____

Name of Your School: ______________________________________

Teacher Background Questionnaire

Thank you for taking the time to complete this survey. It will take approximately 15 minutes of your time. Of course, there are no right or wrong answers to these questions. Please answer as truthfully and completely as possible. The surveys will be collected, coded and analyzed by researchers at Wilfrid Laurier University in order to ensure complete confidentiality. Only group means will be reported so no one will be able to identify your response or anyone else's responses to the questions below.

Age: ______________ **Gender:** Male Female

Education (check highest level obtained): _____Secondary
_____Secondary plus some post-secondary
_____College Diploma
_____University degree
_____Master's Degree
_____Doctoral Degree

Current teaching assignment:

In which grade(s) do most of your current teaching responsibilities fall (circle all that apply):

JK SK 1 2 3 4 5 6

Past teaching experience:

Total number of years teaching: ______________

Total number of years throughout teaching in each division:

Primary ______________
Junior ______________
Intermediate ______________
Senior ______________

I. GENERAL COMPUTER USE

A. In general, how comfortable do you feel about using computers?

Very Comfortable		Neutral		Very Uncomfortable
1	2	3	4	5

B. In general, how comfortable do you feel about using computers **in the classroom?**

Very Comfortable		Neutral		Very Uncomfortable
1	2	3	4	5

C. On average, how many minutes or hours per week do you spend on your **home computer** for the following activities:

1. Personal Use: _________ mins. or __________ hrs. per week
2. School or Work Related Tasks: _________ mins. or __________ hrs. per week

D. On average, how many minutes or hours per week do you spend on **school computers** for the following activities:

1. Personal Use: _________ mins. or __________ hrs. per week
2. School or Work Related Tasks: _________ mins. or __________ hrs. per week

II. COMPUTER USE AT SCHOOL

Answer these questions relative to your **current situation.**

A. Do you have **access** to computers in:			
1. your classroom?	1.	Yes	No
2. a lab in your school?	2.	Yes	No
3. a library or resource centre in your school?	3.	Yes	No
4. pod area?	4.	Yes	No
5. staff room?	5.	Yes	No

B. How often do **you as a teacher** use a:

	Never	A Few Times a Year	A Few Times a Month	A Few Times a Week	Every Day
1. Classroom computer………………………	1. …☐…	…☐…	…☐…	…☐…	…☐…
2. Lab computer……………………………	2. …☐…	…☐…	…☐…	…☐…	…☐…
3. School library/Resource room computer..	3. …☐…	…☐…	…☐…	…☐…	…☐…
4. Pod area………………………………	4. …☐…	…☐…	…☐…	…☐…	…☐…
5. Computer in another location in your school	5. …☐…	…☐…	…☐…	…☐…	…☐…

C. How often do **your students** use a:

	Never	A Few Times a Year	A Few Times a Month	A Few Times a Week	Every Day
1. Classroom computer………………………	1. …☐…	…☐…	…☐…	…☐…	…☐…
2. Lab computer……………………………	2. …☐…	…☐…	…☐…	…☐…	…☐…
3. School library/Resource room computer..	3. …☐…	…☐…	…☐…	…☐…	…☐…
4. Pod area………………………………	4. …☐…	…☐…	…☐…	…☐…	…☐…
5. Computer in another location in your school	5. …☐…	…☐…	…☐…	…☐…	…☐…

D. How often do you integrate computers when you are teaching the following :

	Never	Sometimes	A Moderate Amount	Quite a Bit	A Great Deal
1. Pre-Reading/Reading	1. …☐…	…☐…	…☐…	…☐…	…☐…
2. Writing	2. …☐…	…☐…	…☐…	…☐…	…☐…
3. Mathematics	3. …☐…	…☐…	…☐…	…☐…	…☐…
4. Social Studies	4. …☐…	…☐…	…☐…	…☐…	…☐…
5. The Arts: Music	5. …☐…	…☐…	…☐…	…☐…	…☐…
6. The Arts: Visual Arts	6. …☐…	…☐…	…☐…	…☐…	…☐…

E. In **comparison to the average teacher**, how would you rate your ability to integrate computer technology?

Much Less Skilled		Equal		Much More Skilled
1	2	3	4	5

F. To what extent do you **integrate computer technology** in the classroom?

Not at All		A Moderate Amount		A Great Deal
1	2	3	4	5

G. When you are **planning** a unit, how often do you assume that computer use by students will be part of your instructional plan?

Not at All		A Moderate Amount		A Great Deal
1	2	3	4	5

H. Are you familiar with any of the following software? If yes, please indicate how frequently you use each with your students.

Software	Familiarity	Never	A Few Times A Year	A Few Times A Month	A Few Times A Week	Every Day
		1	2	3	4	5
Reader Rabbit	Yes No	1	2	3	4	5
Bailey's Book House	Yes No	1	2	3	4	5
ABCircus	Yes No	1	2	3	4	5
Read, Write and Type	Yes No	1	2	3	4	5
A to Zap	Yes No	1	2	3	4	5
Kid Pix	Yes No	1	2	3	4	5
Storybook Weaver	Yes No	1	2	3	4	5
Millie's Math House	Yes No	1	2	3	4	5
Sammy's Science House	Yes No	1	2	3	4	5
ABRACADABRA	Yes No	1	2	3	4	5
Academy of Reading	Yes No	1	2	3	4	5
Wiggleworks	Yes No	1	2	3	4	5
Appleworks Tutorials	Yes No	1	2	3	4	5
CyberPhonics	Yes No	1	2	3	4	5
Books on CD	Yes No	1	2	3	4	5
Kurzweil	Yes No	1	2	3	4	5
Inspiration/Kidspiration	Yes No	1	2	3	4	5

I. Please list any other computer software that you use with your students and the frequency with which you use it.

____
____
____
____

III. PROFESSIONAL DEVELOPMENT

A. Have you participated in any professional development workshops related to **computers** in the past five years?

1. Yes or No

2. If yes, how many (estimate)? ___________

B. What **other forms** of professional development about **computers** have you engaged in during the **past 5 years**?	Please check all that apply. 1. Conferences _________ 2. Online training_________ 3. Talking with colleagues_________ 4. Videos _________ 5. Journals/books _________ 6. Courses _________ 7. Self-directed, hands-on learning _______ 8. Other _________ (Please Specify __________)

C. Have you participated in any professional development workshops related to **literacy** in the past five years?

1. Yes or No

2. If yes, how many (estimate)? ___________

D. What **other forms** of professional development about **literacy** have you engaged in during the **past 5 years**?	Please check all that apply. 1. Conferences _________ 2. Online training _________ 3. Talking with colleagues_________ 4. Videos _________ 5. Journals/books _________ 6. Courses _________ 7. Self-directed, hands-on learning _________ 8. Other _________ (Please Specify___________)

IV. YOUR VIEWS ON COMPUTERS

A. Please indicate your level of agreement with each of the following statements:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I see computers as tools that can complement my teaching	1. ...☐...	...☐...	...☐...	...☐...	...☐..
2. I believe that computer technology is only appropriate in specific topic areas	2. ...☐...	...☐...	...☐...	...☐...	...☐..
3. Computers provide variety in instruction and in content for my students	3. ...☐...	...☐...	...☐...	...☐...	...☐..
4. Computers are useful for students who have special needs	4. ...☐...	...☐...	...☐...	...☐...	...☐..
5. I use computers to motivate my students	5. ...☐...	...☐...	...☐...	...☐...	...☐..
6. Having computers provides opportunities for individualized instruction	6. ...☐...	...☐...	...☐...	...☐...	...☐..
7. Computer technology allows me to bring current information to the class	7. ...☐...	...☐...	...☐...	...☐...	...☐..
8. Computers are an ideal reward for students	8. ...☐...	...☐...	...☐...	...☐...	...☐..
9. Computers allow students an opportunity to play while learning	9. ...☐...	...☐...	...☐...	...☐...	...☐..
10. Computer technology has improved my effectiveness as a teacher	10...☐...	...☐...	...☐...	...☐...	...☐..
11. I feel I am trained well enough to use computers when teaching	11...☐...	...☐...	...☐...	...☐...	...☐..
12. I do not have enough support at my school to be able to use technology in the way others seem to be using it....	12...☐...	...☐...	...☐...	...☐...	...☐..
13. I find computer equipment unreliable	13...☐...	...☐...	...☐...	...☐...	...☐..
14. Whenever I plan to use computers, the machines crash or don't work	14...☐...	...☐...	...☐...	...☐...	...☐..
15. The computer equipment at my school is not up to date	15...☐...	...☐...	...☐...	...☐...	...☐..
16. Our school does not have the resources (human or financial) to maintain computers effectively	16...☐...	...☐...	...☐...	...☐...	...☐..
17. I'd like to use computers but I have trouble getting access to them when I need them for my class	17...☐...	...☐...	...☐...	...☐...	...☐..
18. My students are not old enough to use computers effectively ..	18...☐...	...☐...	...☐...	...☐...	...☐..
19. I spend more time planning/preparing for classes where I use computers than when I don't use computers	19...☐...	...☐...	...☐...	...☐...	...☐..
20. My students often request opportunities to use computers	20...☐...	...☐...	...☐...	...☐...	...☐..
21. I feel frustrated more often when I use computers in my classes than when I don't use them	21...☐...	...☐...	...☐...	...☐...	...☐..
22. I like to tinker or "play" with computers myself	22...☐...	...☐...	...☐...	...☐...	...☐..

23. When I use computers my teaching style changes	23...☐... ...☐... ...☐... ...☐... ...☐..
24. I had positive experiences with computers when I was younger	24...☐... ...☐... ...☐... ...☐... ...☐..
25. I have positive computer technology experiences in school	25...☐... ...☐... ...☐... ...☐... ...☐..
26. I have positive computer technology experiences at home	26...☐... ...☐... ...☐... ...☐... ...☐..
27. In general, I am interested in computer technology	27...☐... ...☐... ...☐... ...☐... ...☐..

Thank you for your time and participation. Please return the survey in the envelope provided.

Appendix D

University letterhead

Dear Teacher,

Over the past weeks you have been participating in a collaborative research project involving the ABRACADABRA (ABRA) reading software program. The research is being conducted by researchers in Alberta (Dr. Noella Piquette-Tomei), Ontario (Dr. Eileen Wood) and Quebec (The Center for the Study of Learning and Performance (CSLP). The researchers in Ontario would like to include a short survey as part of this study. The survey asks questions about your experiences with computers. For example, the survey will ask how often you use computers, how comfortable you feel with computers and your experiences with computer software such as the ABRACADABRA program. The responses from the survey will help us to understand what might make the reading software program easier to implement in future studies.

What about Confidentiality?

All information that is collected in this survey is anonymous. You will not be asked to provide your name or other identifying information (e.g., school name etc.). Each teacher will be assigned a code. Any information collected, will only be referred to by this code. Research presentations and academic publications about this study will not contain any personal or identifying information about those who participate. Only group averages will be presented. All data will be stored in a locked lab room at Laurier for about 5 years at which point it will be destroyed. Access to this lab room is restricted to research personnel and graduate students, all of whom have been trained in the ethical conduct of research.

Participation in this study is completely voluntary. You are free to decline participation at any point without any negative consequences. The ABRA program is offered free to all participants and will remain accessible even if participants decline their participation.

Who has reviewed this project?

This project has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University. If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. Bill Marr, Chair, University Research Ethics Board, Wilfrid Laurier University, (519) 884-0710, extension 2468. If you have questions at any time about the study or the procedures, (or you experience any problems as a result of participating in this study) please feel free to contact the researcher, Dr. Eileen

Wood in the Department of Psychology at Wilfrid Laurier University 519-884-1970 ext. 3738.

We hope you will be willing to participate in this exciting research. If you are willing, please sign the attached consent form.

Sincerely,

Eileen Wood, Ph.D.

Consent Form:

- ☐ I have read the above statement outlining the survey being conducted by Dr. Eileen Wood at Wilfrid Laurier University and give my consent to participate in this research project

Name (Print) ________________________________

Signature ________________________________

Date________________________________

Please keep the letter for your records, and return the consent form and survey in prepaid, addressed envelope provided. Thank you.

Appendix E

ID Code:_______

Your Name: ______________________________________

Name of Your School: _____________________________________

Teacher Background Questionnaire

Thank you for taking the time to complete this survey. It will take approximately 15 minutes of your time. Of course, there are no right or wrong answers to these questions. Please answer as truthfully and completely as possible. The surveys will be collected, coded and analyzed by researchers at Wilfrid Laurier University in order to ensure complete confidentiality. Only group means will be reported so no one will be able to identify your response or anyone else's responses to the questions below.

Age: ______________ **Gender:** Male Female

Education (check highest level obtained):
_____Secondary
_____Secondary plus some post-secondary
_____College Diploma
_____University degree
_____Master's Degree
_____Doctoral Degree

Current teaching assignment:
In which grade(s) do most of your current teaching responsibilities fall (circle all that apply):

JK SK 1 2 3 4 5 6

Past teaching experience:

Total number of years teaching: _____________

Total number of years throughout teaching in each division:

Primary _____________
Junior _____________
Intermediate _____________
Senior _____________

I. GENERAL COMPUTER USE

A. In general, how comfortable do you feel about using computers?

Very Comfortable		Neutral		Very Uncomfortable
1	2	3	4	5

C. In general, how comfortable do you feel about using computers **in the classroom?**

Very Comfortable		Neutral		Very Uncomfortable
1	2	3	4	5

C. On average, how many minutes or hours per week do you spend on your **home computer** for the following activities:

1. Personal Use: ________ mins. or _________ hrs. per week

2. School or Work Related Tasks: ________ mins. or _________ hrs. per week

D. On average, how many minutes or hours per week do you spend on **school computers** for the following activities:

1. Personal Use: ________ mins. or _________ hrs. per week

2. School or Work Related Tasks: ________ mins. or _________ hrs. per week

II. COMPUTER USE AT SCHOOL

Answer these questions relative to your **current situation.**

A. Do you have **access** to computers in:

1. your classroom?	1.	Yes	No
2. a lab in your school?	2.	Yes	No
3. a library or resource centre in your school?	3.	Yes	No
6. pod area?	4.	Yes	No
7. staff room?	5.	Yes	No

B. How often do **you as a teacher** use a:

	Never	A Few Times a Year	A Few Times a Month	A Few Times a Week	Every Day
1. Classroom computer............................	1. ...☐...	...☐...	...☐...	...☐...	...☐...
2. Lab computer....................................	2. ...☐...	...☐...	...☐...	...☐...	...☐...
3. School library/Resource room computer..	3. ...☐...	...☐...	...☐...	...☐...	...☐...
4. Pod area..	4. ...☐...	...☐...	...☐...	...☐...	...☐...
5. Computer in another location in your school	5. ...☐...	...☐...	...☐...	...☐...	...☐...

C. How often do **your students** use a:

	Never	A Few Times a Year	A Few Times a Month	A Few Times a Week	Every Day
1. Classroom computer............................	1. ...☐...	...☐...	...☐...	...☐...	...☐...
2. Lab computer....................................	2. ...☐...	...☐...	...☐...	...☐...	...☐...
3. School library/Resource room computer..	3. ...☐...	...☐...	...☐...	...☐...	...☐...
4. Pod area..	4. ...☐...	...☐...	...☐...	...☐...	...☐...
5. Computer in another location in your school	5. ...☐...	...☐...	...☐...	...☐...	...☐...

D. How often do you integrate computers when you are teaching the following :

	Never	Sometimes	A Moderate Amount	Quite a Bit	A Great Deal
1. Pre-Reading/Reading	1. ...☐...	...☐...	...☐...	...☐...	...☐...
2. Writing	2. ...☐...	...☐...	...☐...	...☐...	...☐...
3. Mathematics	3. ...☐...	...☐...	...☐...	...☐...	...☐...
4. Social Studies	4. ...☐...	...☐...	...☐...	...☐...	...☐...
5. The Arts: Music	5. ...☐...	...☐...	...☐...	...☐...	...☐...
6. The Arts: Visual Arts	6. ...☐...	...☐...	...☐...	...☐...	...☐...

E. In **comparison to the average teacher**, how would you rate your ability to integrate computer technology?

Much Less Skilled		Equal		Much More Skilled
1	2	3	4	5

F. To what extent do you **integrate computer technology** in the classroom?

Not at All		A Moderate Amount		A Great Deal
1	2	3	4	5

G. When you are **planning** a unit, how often do you assume that computer use by students will be part of your instructional plan?

Not at All		A Moderate Amount		A Great Deal
1	2	3	4	5

H. Are you familiar with any of the following software? If yes, please indicate how frequently you use each with your students.

Software	Familiarity	Never	A Few Times A Year	A Few Times A Month	A Few Times A Week	Every Day
		1	2	3	4	5
Reader Rabbit	Yes No	1	2	3	4	5
Bailey's Book House	Yes No	1	2	3	4	5
ABCircus	Yes No	1	2	3	4	5
Read, Write and Type	Yes No	1	2	3	4	5
A to Zap	Yes No	1	2	3	4	5
Kid Pix	Yes No	1	2	3	4	5
Storybook Weaver	Yes No	1	2	3	4	5
Millie's Math House	Yes No	1	2	3	4	5
Sammy's Science House	Yes No	1	2	3	4	5
ABRACADABRA	Yes No	1	2	3	4	5
Academy of Reading	Yes No	1	2	3	4	5
Wiggleworks	Yes No	1	2	3	4	5
Appleworks Tutorials	Yes No	1	2	3	4	5
CyberPhonics	Yes No	1	2	3	4	5
Books on CD	Yes No	1	2	3	4	5
Kurzweil	Yes No	1	2	3	4	5
Inspiration/Kidspiration	Yes No	1	2	3	4	5

I. Please list any other computer software that you use with your students and the frequency with which you use it.

____

____

____

____

III. PROFESSIONAL DEVELOPMENT

A. Have you participated in any professional development workshops related to **computers** in the past five years?

1. Yes or No

2. If yes, how many (estimate)? ___________

B. What **other forms** of professional development about **computers** have you engaged in during the **past 5 years**?	Please check all that apply. 1. Conferences _________ 2. Online training_________ 3. Talking with colleagues_________ 4. Videos _________ 5. Journals/books _________ 6. Courses _________ 7. Self-directed, hands-on learning ________ 8. Other _________ (Please Specify ___________)

C. Have you participated in any professional development workshops related to **literacy** in the past five years?

1. Yes or No

2. If yes, how many (estimate)? ___________

D. What **other forms** of professional development about **literacy** have you engaged in during the **past 5 years**?	Please check all that apply. 1. Conferences _________ 2. Online training _________ 3. Talking with colleagues_________ 4. Videos _________ 5. Journals/books _________ 6. Courses _________ 7. Self-directed, hands-on learning _________ 8. Other _________ (Please Specify___________)

IV. YOUR VIEWS ON COMPUTERS

A. Please indicate your level of agreement with each of the following statements:

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I see computers as tools that can complement my teaching	1.	☐	☐	☐	☐	☐
I believe that computer technology is only appropriate in specific topic areas	2.	☐	☐	☐	☐	☐
Computers provide variety in instruction and in content for my students	3.	☐	☐	☐	☐	☐
Computers are useful for students who have special needs	4.	☐	☐	☐	☐	☐
I use computers to motivate my students	5.	☐	☐	☐	☐	☐
Having computers provides opportunities for individualized instruction	6.	☐	☐	☐	☐	☐
Computer technology allows me to bring current information to the class	7.	☐	☐	☐	☐	☐
Computers are an ideal reward for students	8.	☐	☐	☐	☐	☐
Computers allow students an opportunity to play while learning	9.	☐	☐	☐	☐	☐
Computer technology has improved my effectiveness as a teacher	10.	☐	☐	☐	☐	☐
I feel I am trained well enough to use computers when teaching	11.	☐	☐	☐	☐	☐
I do not have enough support at my school to be able to use technology in the way others seem to be using it	12.	☐	☐	☐	☐	☐
I find computer equipment unreliable	13.	☐	☐	☐	☐	☐
Whenever I plan to use computers, the machines crash or don't work	14.	☐	☐	☐	☐	☐
The computer equipment at my school is not up to date	15.	☐	☐	☐	☐	☐
Our school does not have the resources (human or financial) to maintain computers effectively	16.	☐	☐	☐	☐	☐
I'd like to use computers but I have trouble getting access to them when I need them for my class	17.	☐	☐	☐	☐	☐
My students are not old enough to use computers effectively	18.	☐	☐	☐	☐	☐
I spend more time planning/preparing for classes where I use computers than when I don't use computers	19.	☐	☐	☐	☐	☐
My students often request opportunities to use computers	20.	☐	☐	☐	☐	☐
I feel frustrated more often when I use computers in my classes than when I don't use them	21.	☐	☐	☐	☐	☐
I like to tinker or "play" with computers myself	22.	☐	☐	☐	☐	☐

When I use computers my teaching style changes ……	23…☐…	…☐…	…☐…	…☐…	…☐..
I had positive experiences with computers when I was younger ……	24…☐…	…☐…	…☐…	…☐…	…☐..
I have positive computer technology experiences in school ….	25…☐…	…☐…	…☐…	…☐…	…☐..
I have positive computer technology experiences at home ……	26…☐…	…☐…	…☐…	…☐…	…☐..
In general, I am interested in computer technology …………..	27…☐…	…☐…	…☐…	…☐…	…☐..

V. YOUR VIEWS ABOUT THE ABRACADABRA SOFTWARE

A. Please indicate your level of agreement with each of the following statements:

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Do you like teaching ABRA classes?	1. …☐…	…☐…	…☐…	…☐…	…☐…
Do your students like ABRA classes?……………..	2. …☐…	…☐…	…☐…	…☐…	…☐…
Is ABRA easy for you to use?…………………	3. …☐…	…☐…	…☐…	…☐…	…☐…
Is it easy to teach students to use the software ?…..	4. …☐…	…☐…	…☐…	…☐…	…☐…
Does use of the software help your students to learn?……..	5. …☐…	…☐…	…☐…	…☐…	…☐…
Does use of the software make your teaching easier?…………	6. …☐…	…☐…	…☐…	…☐…	…☐…
Was your training good preparation for using the software?...	7. …☐…	…☐…	…☐…	…☐…	…☐…

B. i. How many times a week do your students have ABRA classes? ________

ii. How long is a typical period spent in an ABRACADABRA class?____ (minutes)

iii. Have there been any instances where you have had to cancel an ABRACADABRA class?

Never		Sometimes		Regularly
1	2	3	4	5

If so, what were the reasons? (please indicate the number of times for each category)
________School cancellations (snow, professional development, field trips, etc.)
________Scheduling problems with the computer lab
_______ Computer malfunctions
________Your absence
________Other(please elaborate)____________________________________

iv. How often do you need help to use the ABRACADABRA program?

Never 1	2	Sometimes 3	4	Regularly 5

v. When you needed help, how often did you seek the assistance of the in-class research assistance?

Never 1	2	Sometimes 3	4	Regularly 5

vi. How helpful was it to have the in-class research assistant available?

Not at all helpful 1	2	Somewhat helpful 3	4	Very helpful 5

vii. What source of help would you have used if the research assistant was not available?

____
____
____
____

Thank you for your time and participation. Please return the survey in the envelope provided

Appendix F

Just-In-Time Instruction Observations

Observer:		**Teacher ID:**	
School:		**Grade level:**	

Total Session Length (minutes):	
Total number of students in session:	

Focus (Please check under all that apply for session):

Alphabetics	Reading (Fluency)	Understanding the Story (Comprehension)	Writing
☐	☐	☐	☐

Components/Activities Observed: Approximate Time (minutes): # Children Involved

Alphabetics:	y/n	Time (Min.)	# students	Reading:	y/n	Time (Min.)	# students
Matching Sounds	☐			High Frequency Words	☐		
The Alphabet Song	☐			Tracking	☐		
Word Counting	☐			Expression	☐		
Syllable Counting	☐			Accuracy	☐		
Same Word	☐			Speed	☐		
Same Phoneme	☐						
Word Matching	☐						
Animated Alphabet	☐						
Letter Sound Search	☐						
Letter ID Bingo	☐						
Rhyme Matching	☐						
Word Families	☐						
Auditory Blending	☐						
Auditory Segmenting	☐						

Blending Train	☐						
Basic Decoding	☐						
Word Changing	☐						

Comprehension:	**y/n**	**Time (Min.)**	**# students**	**Writing:**	**y/n**	**Time (Min.)**	**# students**
Story Prediction	☐			Spelling Words	☐		
Comprehension Monitoring	☐			Spelling Sentences	☐		
Sequencing	☐						
Summarizing	☐						
Vocabulary	☐						
ESL Vocabulary	☐						
Story Response	☐						
Story Elements	☐						

Other notes regarding topic or set up of session (others present / combined with other technologies / switching from group to individual / etc.)

Overall Degree of Implementation (e.g., Full = whole class in lab; Partial = only some students using ABRA; None = no students on ABRA):

None	**Partial**	**Full**	**Notes:**
☐	☐	☐	

Fidelity of Instruction (i.e., Teacher's level of instructions/directions to students)

Poor	Adequate	Excellent	Notes:
☐	☐	☐	

Overall Student Involvement (e.g., Are students engaged, on-task, etc.?):

Poor	Adequate	Excellent	Notes:
☐	☐	☐	

***Just In Time*: Support requests/questions from teacher during session**

- Document question, response, whether solution was achieved, and relative amount of time)
- Also indicate instances where an issue/problem arose and help was NOT sought by teacher

During Session Only:

Computer/hardware Issues	Computer Software issues	Classroom Management Issues	Reading Issues	Other?

Before or After Session Only (indicate whether before or after):

Computer/hardware Issues	Computer Software issues	Classroom Management Issues	Reading Issues	Other?

Any additional notes (Also attach record of emails, phone calls, etc. for this session)**:**

Appendix G

Letter Sound Knowledge Instructions and Scoring

Child ID________________ Date________ Time________

"Have a look at these letters. Can you tell me the **sound** that goes with these letters?"

Note: make sure to note all responses (correct or otherwise). If child responds with the letter name rather than the sound, then say: "that is the name of the letter. Can you tell me what **sound** goes with it?"

Note: if correct, put a check, if incorrect, put a slash, mark if the vowel is long or short

Session A

k b y f g r

I p l o v a d

Session B

c n s e u j z

m t x q h w

Total Correct________________________________

Appendix H

Fry's word list Scoring Sheet

1. Take stimulus and cut into individual word cards
2. Administer 20 words at random (have child read aloud word)

For scoring:

- Write word administered
- Write child's response
- Score 0 if incorrect, 1 if correct

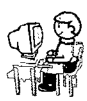
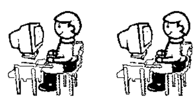
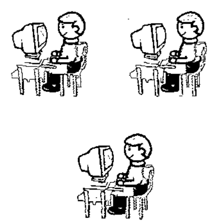
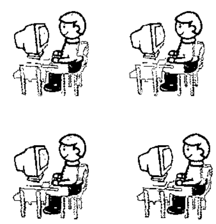
Word Administered	**Student's Response**	**Score 1/0**
1. we		
2. do		
3. two		
4. call		
5. are		
6. some		
7. no		
8. had		
9. on		
10. make		
11. were		
12. one		
13. the		
14. was		
15. number		
16. by		
17. like		
18. this		
19. than		
20. out		

Appendix I

Can you show me how much you enjoyed playing on ABRACADABRA? Did playing on ABRACADABRA make you feel Very Unhappy, Very Happy, or somewhere in the middle?

				
Very Unhappy		Neutral		Very Happy

Now can you show me how often you played on ABRACADABRA?

				
Never	Not Very Often	Sometimes	Often	A lot of the Time