

TECHNOLOGY AND AT-RISK YOUNG READERS AND THEIR CLASSROOMS

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This study examined the ways in which 18 first-grade teachers and their students in 11 high-risk urban schools began to use literacy-focused technology. The goal of the study was to observe the technology in use by the students, to observe the classroom dynamics and teachers' instructional choices centered around technology use, to look at student learning, and to investigate student and teacher perceptions and beliefs as they began to use technology for literacy. Analyses of classroom and pupil observational data and of student performance data indicated positive effects of the literacy technology on classroom instruction and student literacy achievement. Further, interviews of students and teachers confirmed that the literacy technology was perceived as engaging and effective by both groups of stakeholders. The study also generated implications for further research and practice in schools struggling to make change.

The *Report of the National Reading Panel* (National Institute of Child Health and Human Development, 2000), a review of scientifically based research on reading, discussed the potential of computer-aided learning technology in the classroom and noted that though there is intense interest in computer technology, there has been relatively little systematic research on computers with respect to early literacy issues, particularly among children considered to be at risk (i.e., low-income, urban; National Institute of Child Health and Human Development, 2000). Of the six studies dealing with early literacy, none focused on urban, at-risk schools.

In a seminal review of the research on technology in early childhood education, Lankshear and Knobel (2003) parsed out the studies of technology and literacy from earlier reviews of research (Kamil & Intrator, 1998; Kamil & Lane,

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1998) and updated this with more current research. They examined studies of computers and composition, the use of hypermedia for literacy instruction, multimedia effects on literacy including work with special populations, the motivational effects of technology, and the potential for collaboration. Their study, with less stringent selection rules than the National Reading Panel report, found 37 studies relevant to early childhood, finding that the majority of the studies involved electronic books and were carried out in exemplary schools and classrooms. Only 4 of the studies examined teacher instruction and none included interviews of or the gathering of perceptions from students (Huntinger & Johanson, 2000; Turbill, 2001; Wepner & Tao, 2002). From these reviews of the field, it can be concluded that more studies of early literacy and technology in at-risk populations will add to the educational knowledge base.

The Research Ground—Technology and Literacy

Labbo and Reinking (1999) note that, for a new technology to be effective in a literacy classroom, it must be:

1. accessible,
2. used to enhance and transform traditional literacy instruction, and
3. used to prepare and empower students for the future.

For the questions related to this study, the relevant research in technology and literacy, then, focuses on access, uses to deliver and transform instruction, and use for empowering of students and, we would add, teachers. Further, we agree with Labbo and Reinking and others (Karchmer, 2001) that studies of technology and literacy need to be clearly contextualized for understanding. The nature of the school, community, students, and teachers may cause research results and research applications to differ widely.

Access

Led by the United Kingdom, the United States, Finland, New Zealand, and Australia, the last decade has seen the launching of major technology initiatives with literacy goals (Leu, 2000). The

2000 National Center for Educational Statistics (NCES, 2000) survey of access to computer technology in U.S. schools indicated that 63% of all had full access to technology including the internet, double those of the beginning of the decade. Yet the same study indicated that a small percentage of students actually used computer technology in their instructional literacy time blocks. This dovetails with studies by Karchmer (2000) and Report of the Web-Based Education Commission to the President and Congress (2000) that there was lack of substantive time in the school day devoted to using computer technology in elementary classrooms. Replication studies in later years (Cattagni & Farris, 2001) confirmed that there were differences in access in different school areas. For example, the ratio of students to instructional computers with Internet access was higher in schools with the highest poverty concentration (6.8 to 1 compared with 4.9 or 5.6 to 1 in other more affluent schools). Despite this gap, the ratio had improved from prior years when there were 9.1 students in schools with the highest poverty concentration without access to instructional computers. So the question of what happens in classrooms when they receive access to new technology remains an important contextual variable in examining technology use in literacy classrooms.

Use to Deliver and Transform Traditional Instruction

Two areas of literacy important to primary classrooms are those of decoding/word identification and spelling/encoding (Morris & Perney, 1984; Snow, Burns, & Griffin, 1998). Some of the earliest research on young readers, literacy, and computer technology focused on these two areas. With respect to word identification, the preponderance of research suggests that computer-assisted instruction in the phonological components of word identification is beneficial (Barker & Torgesen, 1995; Foster, Erickson, Foster, Brinkman, & Torgesen, 1994). The research on spelling is more equivocal. Though computer delivery of spelling instruction has sometimes proved effective, the techniques studied have been no more effective than paper-and-pencil practice. Researchers have hypothesized (Berninger et al., 1998) that this is due to the fact that these programs are primarily rote practice rather than instruction focusing on generative spelling patterns. In his review of the potential of technology for transforming early reading

instruction, particularly those aspects related to word recognition and decoding, McKenna (1998) suggests that it is the interactive and supported nature of successful research that brings about improved reading performance. So an examination of literacy programs that include a theoretically sound, interactive approach would seem a legitimate endeavor.

Context of the Study

With this research backdrop, the study reported in this article was undertaken as a follow-up to larger study of the Advanced Reading Development Demonstration Project (ARDDP), a 5-year project funded by the Chicago Community Trust and the Chicago Public Schools. The goal of the project was to build capacity for improved literacy instruction in low-functioning Chicago public schools (Blachowicz, Buhle, Frost, & Bates, 2005; DeStefano, Hanson, & Kallemeyn, 2005). In this study, we gathered a significant amount of baseline data on what are called Tier 2 schools (second to the last quartile). Environmental scans (see Appendix A) were first carried out to establish the initial environment for literacy. Then classes were systematically observed for 2-hour literacy instructional blocks over a 3-year period to capture the type of work that went on in the specified environment. This provided baselines of practice that could be used as the background for examining how instruction changed as technology became available to the students and teachers in these classrooms.

One area of observation was the availability and use of technology. The typical number of computers available to a class of 22–28 students was four, paralleling the NCES study (2000) of at-risk schools and making use difficult to establish even if time were to be devoted to technology integration. The literacy software available prior to this study was comprised of a drill and practice phonics program that matched the classroom basal reading program workbooks (never observed in use) and electronic books, which were used as center work.

At the same time our first study was completed, some of the schools with which we worked were provided with literacy software, the Innovations for Learning Computer Reading Program, which underlies both desktop and the Teacher Mate handheld computers being tested in the system. In our schools, the

desktop programs had just become available. This offered us an opportunity to continue to observe our classrooms where access was guaranteed and to look at what effect the use of this technology might have on student learning as well as any changes in teacher instruction.

This study examines the ways in which 18 first-grade teachers and their students in 11 at-risk urban schools began to use literacy-focused technology. The goal of the study was to observe the technology in use by the students, to observe the classroom dynamics and teacher choices centered on the technology use, to look at student learning, and to learn about student and teacher perceptions and beliefs about technology. The questions under study were

1. What do first-grade classrooms in at-risk schools beginning to use a computer-assisted literacy instruction program look like? This question would be addressed by observations of the classroom as a whole, focusing in particular on how teachers incorporate technology in their instructional program.
2. How do first-grade teachers in at-risk schools begin to utilize a computer-assisted literacy instruction and what are their initial perceptions about this tool? This question was addressed by observation and interview.
3. How do first-grade students begin to use and perceive computer-assisted literacy instruction? This question would be addressed by shadow observations of students as they used technology and through interviews.
4. In the first year of an adoption phase of new literacy technology, what, if any, was the effect of computer-assisted reading instruction programs on the reading performance of first-grade students? This question, including examinations of high- and low-use students, was addressed by analysis of assessment results.

In essence, rather than observing exemplary use of literacy technology, we were looking at the first use of such technology in nonexemplary schools that were struggling to make change.

Structure of the Study

Participants

Participants were 18 first-grade teachers and their students from 11 high-risk schools in a major mid-Western city. The schools are classified as “at-risk” based on two criteria: historical school performance data and family income level. Additionally, 11 comparison schools not using this kind of technology to support early reading were selected as matches based on the demographics of locale, performance, ethnicity, and free-lunch data. Schools were predominantly African American and Latino/a with 88–99% of the students eligible for free and reduced-price lunch. All were identified as struggling schools where teachers were working to make change.

The teachers in the study ranged from four in their first year of teaching to seven who had taught for over 10 years, including three who had taught from 18 to 38 years. The 18 students shadowed (9 males, 11 females) were randomly selected from the reading group the teacher designated as “average.”

Computer-Assisted Literacy Program

Innovations for Learning (IFL, 2006) is an Illinois not-for-profit corporation that develops technology-based curriculum materials for beginning reading instruction and has provided its curriculum as a public service to urban, high-risk schools for over 11 years. In consultation with leading local and national reading educators, IFL software was designed with print and manipulative materials that can provide an engaging supplementary reading program for K–2 students.

The program is based on current research on early literacy (Ehri, 1983, 1991; Morris, Bloodgood, Lomax, & Perney, 2003; Morris & Perney, 1984; Snow et al., 1998) and is specifically designed to meet the Illinois Reading First and Chicago Reading Initiative Framework guidelines. These guidelines require a strong phonics component, which focuses on onset and rime (the addition of consonants and consonant clusters to ending phonograms; e.g., ch + at = chat) and introduces the students to approximately 100 of the basic phonograms in the English language.

The IFL learning experience is enriched with sorting and dictation spelling activities to help students develop the skills needed to decode and spell new words. All these components reflect meta-analyses of research that support their importance in early literacy (Adams, 1990).

The curriculum is organized around learning stations to which small groups of students rotate through defined sections of the curriculum. Because the students are grouped by developmental reading level, which is assessed and monitored through the program, the instruction matches their educational needs and they can progress more quickly than students in an undifferentiated whole-group setting. The result is that students are so engaged in their groups and learning stations that the teacher can spend extended, uninterrupted time working individually with a student who needs additional attention or conducting a specialized learning station for a group of students. The IFL program is designed to be accessible to schools with limited budgets and technological resources. The software runs on basic PC platform computers as well as on handheld devices, which allows schools to supply participating classrooms with the needed computer resources at a very low price. IFL facilitators also visited the schools weekly to troubleshoot, fix computers, and answer questions.

Data Gathering Measures

There were five types of data gathering measures utilized in the study.

1. Environmental scan: This protocol for observing first-grade classrooms was adapted from those developed for ARDDP (Blachowicz et al., 2005) to document the instructional environment (see Appendix A). It is used to get a first sense of the classroom at the time of the initiation of the study by looking at the physical setting.
2. Structured observation rubric: This protocol for observing first-grade classrooms was adapted from those developed for the ARDDP (Blachowicz et al., 2005) to document instruction and technology use by students (see Appendix B). This is a timeline notation that records teacher and pupil actions at 5-minute intervals (Patton, 1990). Categories of classification

were derived from observations of early literacy classrooms developed by Barr and Dreeben (1983).

3. Teacher interview protocol: This protocol for interviewing first-grade teachers included structured questions and open response (see Appendix C). The method of constant comparison (Patton, 1990) was used to search for themes in the responses.
4. Student interview protocol: This protocol for interviewing first-grade students included structured questions and open response (see Appendix D). The method of constant comparison (Patton, 1990) was used to search for themes in the responses.
5. Measure of student performance: Student performance measures were subtests of the CPS mandated assessment, the *Dynamic Indicators of Early Literacy Skills* (DIBELS; Good & Kaminski, 2002) and the developmental spelling test of the *Illinois Snapshot of Early Literacy* (Barr, Blachowicz, & Buhle, 2004). Data for comparative performance were gathered from 11 schools matched on demographic data relating to prior performance on state tests, ethnicity, free and reduced lunch, and geographic locale. Data for comparative spelling performance were gathered from norming data from the *Illinois Snapshot of Early Literacy* (Barr et al.) from the matched area demographic scores.

Procedures

All observations were carried out in spring of the school year when the technology had been in place for over 7 months. They were carried out by trained reading specialists who were also university doctoral faculty. Each of the 18 participating first-grade teachers in 11 schools was visited for a full reading period of 2 hours, with added time for teacher interview. During this reading time, observers first did an environmental scan, observed classroom instruction, and observed the use of technology. One student was randomly selected from the group of students identified as in the average reading group by the teacher ($N = 18$). This student was shadowed during his or her technology time in the literacy block. The observer sat with the student and observed the technology use. At the close of the student's technology session, the student was interviewed about the activities.

Data Analysis

Responses of the teachers and students to the interview and the observation data were summarized and analyzed by two researchers using the method of constant comparison focusing on inductive, cross-case analysis (Patton, 1990). Interrater reliability was .91 on the interviews and .88 on the observation scale with all differences in coding resolved before final analysis. T-tests and correlational analyses were used to examine the student performance data.

Results and Discussion

Teachers' Use of Technology

Environmental scans of the 18 classrooms indicated that most were adequately organized to motivate and support readers. Most significantly, all of the classrooms had at least a basic collection of books for independent reading, with over 83% of the classrooms having large collections of books readily accessible to students with a comfortable space, typically a rug corner, sometimes with pillows, for them to do their personal reading. One classroom had erected a tent as a reading place, much to the delight of the students. These same classrooms had books attractively displayed to motivate students to read them, with over half of the classrooms displaying reading motivational posters. Smaller collections of magazines and reading games were available to students in over 75% of the classrooms as well. All these stand in marked contrast to high-risk classrooms observed at the inception of the ARDDP project where fewer than 50% of the primary classrooms had adequate and accessible classroom libraries and motivational tools.

Physically, over 90% of the classrooms were set up to allow for a variety of grouping possibilities, typically a large rug or group area with some smaller center-type locations. Even the classrooms organized in traditional rows had rug areas for group work. All classrooms had computer centers, though several were not set up in a way to be conducive to comfortable work. One had computers on windowsills with no chairs for the students, making working

there a tiring proposition. Only two classrooms had added literacy software other than IFL software and these were electronic books.

The size of the classes often made dedicating space to a center difficult, with most classes having 17–22 pupils, with eight ranging in size from 22 to 26 students. The most common centers, besides the computer center, were the independent reading center and the listening center, most of the latter with books and tapes for student use. Most noticeable by absence was the lack of writing centers and of easily accessible writing materials. Forty percent of the classrooms had no visible writing centers and no visible location for students to easily access writing materials, papers, pens, pencils, and crayons. Only 33% of the classrooms were rated as well equipped in this regard. Similarly, only 33% of the classrooms had significant displays of student work that went beyond worksheet or copying types of activities. Also limited in accessibility were other media devices. Sixty percent of the teachers had access to overhead projectors and CD players or tape recorders, with fewer than half having access to a personal or shared television/VCR. These were numbers more representative of lower functional classrooms in our earlier first-grade observations. In this way, the classrooms resembled higher functioning classrooms in the second tier of performance.

In summary, the structure of the environments of the majority of the classrooms indicated that the teachers were aware of the need for appropriate materials and spatial organizations for literacy instruction. These, and the presence of centers, posters, word walls, and labels, were characteristic of a broader perspective on literacy than typical in many high-risk classrooms. The major exception was in the area of writing and the importance of writing for the development of overall literacy in primary students.

There were two indicators in which the target schools resembled higher functioning schools rather than lower functioning one. One area of observation was the use of technology. Our data for Tier 2 schools had established a baseline of a range of between 0 and 11 minutes of technology use in a first-grade literacy block, with the modal time being 0 minutes. In spring of the school year, our comparison schools were still at this point, but the 18 treatment classrooms had a range of between 0 and 31 minutes of technology use in the literacy block, with the modal use being

14 minutes. So time devoted to technology use had increased. A second indicator was the use of grouping.

Whereas baseline data for Tier 2 schools showed only 11% of the first-grade classroom teachers used other than whole-class grouping, 16 of the 18 treatment classrooms (89%) showed some attempts at small group work in their regular instruction during the observed literacy blocks. Teacher perceptions of the contributions of the technology helped us understand this change.

Teachers' Perceptions of the Contributions of Literacy Technology

The teachers in the study ranged from four in their first year of teaching to seven who had taught for over 10 years, including three who had taught for between 18 and 38 years. They were unanimous in their positive response to the literacy technology provided by IFL and shared, across experience levels, some of the same perceptions of how the program could be used, what it contributed to student learning, and how it had affected or interacted with their instruction.

Every teacher used IFL as a center through which they cycled their students. About one fourth of the teachers used it every day with all students, with the majority having students use it two to four times a week. Almost all of the students out of 18 classrooms used the programs with the only exceptions being two nonreading students. All the teachers indicated that they viewed IFL mainly as support and practice for the phonics and spelling skills of their students and felt it aligned closely with the demands of first-grade instruction and standards in those areas. This being said, only four teachers were able to give specific examples of the alignment and most indicated that the pace and organization of the program had a general connection to first-grade standards rather than a specific connection to the work of the week. Interestingly, they noted that students were often aware of the connection and remarked to the teacher that they had "learned that word" or "done that type of lesson" in a computer session.

Teachers also perceived transfer of learning to class lessons and one noted, "They just get so much more practice now and it's so much better than the worksheets I used. I could never get to the students as much as the computer does!" Over half indicated that IFL also affected fluency, with fewer than one fourth noting that

it affected comprehension. It is interesting to note that those who mentioned student gains in comprehension made special allusion to the learning of English-language learners (ELL) for whom they felt the ability to listen and relisten to easy selections, as well as the highlighting of vocabulary, helped them understand the material.

Behaviors useful for learning not specifically related to literacy were also highlighted by the teachers. They overwhelmingly noted that students improved in their abilities to listen and work independently and that their technology skills and confidence improved markedly. One teacher noted, "They learned how to work on their own and to focus without being constantly brought back to task." Motivation to use the programs was an outstanding feature contributing to this learning. One teacher also noted that the program was "relaxed and not stressful because they were working on levels on which they could succeed." Many teachers indicated how upset students become if they do not get their turn at the computer cycle and how attentive they were when working. One teacher posited that "this attention carried over to the reading group as well. My students get farther faster than they did before."

Teachers also reported several changes in their own teaching and perceptions about their students and themselves. Common comments were, "I never used technology before" or "I wasn't tech literate" or "I wasn't comfortable with technology and how to use it" before implementing IFL. The relative containment and ease of use of the program seemed to make it a good first step for dipping their toes into the water of instructional technology. This easy entry also changed the perceptions of several teachers about the possibilities of technology. One indicated that she "always just thought stuff like this was games and things, but I could see that the students were really learning something." This comment is important in that it indicates a change in stance toward computer technology.

Several teachers also noted that their pacing had changed since implementing IFL. One noted, "I get farther faster now." Another said, "All that practice helps. Students can move faster without me having to push that practice on them." One factor that seemed to have little impact, however, was the information provided by IFL in terms of student lessons and performance. Four teachers did note that they used the printouts for parent conferences, but only one said she used it for grouping decisions

herself. A significant number of teachers indicated that it seemed too complicated, not relevant, or that they had not really figured out how to get it or use it on their own. Others noted that the school or classroom relied on other measures to form groups such as DIBELS (Good & Kaminski, 2002) and *Illinois Snapshot of Early Literacy* (Barr et al., 2004)

The most significant factors mentioned by every teacher in some form or other was the ability to do more with small groups than they had ever done before. One new teacher indicated, "I was totally unable to figure out how to do groups" before having access to IFL, a comment echoed by several other respondents. Even the teacher with the greatest amount of experience, who noted that IFL had not changed her thinking about reading instruction in general, noted that it allowed her to do small group work in ways she had not been able to do before. Other teachers noted that they were encouraged to try other types of centers because of their success with IFL center work. One noted, "Once I got one center going, I could try another." IFL was definitely a catalyst for differentiated grouping.

Connecting Perceptions to Classroom Observations

The classroom observations confirmed many of the issues raised by the environmental scan and the teacher interviews. As we noted earlier, the environment was conducive to grouping, and some degree of flexible grouping, including small group work, was observed in every class visited. At the very least, students were observed rotating through the computer center while the teacher worked with a subset of the class, smaller groups or individuals. In several classrooms, students worked at the listening center, writing center, and reading center and a regular rotation pattern was observed with some students also leaving for "specials."

A second point confirmed by observation was that the students were motivated, on task, and attentive when working at the IFL center. They moved to this center quickly, got settled and into the program, and, as we will explore further in the next section, seemed to have a grasp of what they were doing and confidence in doing it. The management and approach to the centers was more focused and required less teacher management than many other

aspects of instructional time, freeing the teacher to focus on other issues.

Student Perceptions

Like getting blood from a turnip, getting reflections from a first grader is a difficult task. A few trends were revealed by what were generally not very articulate responses even when carefully probed by master teachers. First, all but two of the students (one of whom seemed angry and upset in general) indicated that they enjoyed the working with literacy program on the computer and exhibited on-task focus. What drew them in was the game-like nature of the phonics and spelling games. Of the children we observed, only one student chose to do a reading part of the lesson. All the rest chose sorting or spelling games.

When asked what they liked, the game-like features were the most often mentioned. "Getting to the top of the dinosaur/ice cream cone" or "Getting more points" were typical responses. When probed, they did have some awareness of what they were doing. Beyond the general statements that they were learning to read words or spell, a few students also indicated that they knew they were "learning to listen to beginning sounds," "learning to read all across the word—the beginning sound and the ending," "learning to put the front part with the back part of the word," "learning which are -ish words, which are -ash words and which are -ush," "learning how to spell with the right letters in a row." These indicated some degree of metacognitive reflection on the part of the students.

One issue that was noted several times was that they were learning how to do better in English, paralleling the teacher's comment that ELL learners seemed to be aware of their learning. Also, some students noted that they were learning how to listen and others commented on the fact that they were learning how to use computers. The fact that there were comments about finding out when you were right matched the observations about confidence that the teacher noted as well. This feedback was viewed as helping them "learn to do better the next time" and did not seem to make the students anxious. In responding to the question about what they would tell kindergarteners about IFL, one student noted that they should not worry, "If you can't read it, it

(the computer) will read it to you and then they can learn to read by themselves,” mirroring the teacher comment that the program was supportive and not stressful. One student tried to sum up the whole experience by saying “I’m learning to read and to spell . . . I’m learning to be a good listener and my mama says that I am smart because I am a good listener!!” Another student noted, “It be real funny,” capturing the engaging quality of the animation and design in a simple statement.

Student Performance

Analyses of student performance also suggest that student performance improved in the classes in which the literacy technology was used. The IFL literacy program is based on scientific research on early literacy (Morris et al., 2003) and emphasizes the learning of onset and rime and using this knowledge for spelling. One would expect, then, that spelling performance would show a difference. Analyses of student performance on the scores from the Spelling subtest of the standardized *Illinois Snapshot of Early Literacy* (Barr et al., 2004) indicated that students in the IFL classrooms performed significantly better on the end-of-year spelling assessment than did students from the matched norming group (IFL student mean = 20.36, SD = 5.15; norming group mean = 18.93, SD = 5.88; $t = 5.12$, $df = 337$, $p < .001$). The difference of 1.43 points between the means resulted in a modest effect size of .24. Though the effect size for the student performance overall was small, examination of the usage patterns of the students also indicated statistically significant ($p < .01$) correlations between both the time spent on IFL and the number of sessions completed with spelling performance, $r = .20$ and $.15$, respectively.

With respect to the DIBELS (Good & Kaminski, 2002), there were no significant differences between the IFL students and the students from the matched control schools at the end of the year when the beginning of the year student score was used as a covariate. All students improved over the course of the year. Interestingly, in the nonsense word subtest of the DIBELS, the subtest most related to the instructional content of the IFL program, the scores of the students who had participated in the IFL program showed a much greater increase over the year as compared to their performance on the other subtests and to the performance

of the control schools. Because the time assessments of the DIBELS are less sensitive and less ecologically valid measures of early literacy performance than tests of developmental spelling that ask students to produce spelling (Swanson, Trainin, Necochea, & Hammill, 2003), the findings on the standardized ISEL spelling measures and the correlation of spelling performance with IFL combine to suggest a positive effect resulting from student use of instructional technology.

Conclusions

In undertaking this examination of the impact of use of literacy technology on instruction and learning in these first-grade classrooms, we were attempting to respond to the National Reading Panel report and surveys of technology use in early literacy classrooms that called for more research on the uses of technology for literacy instruction in high-risk classrooms. It is important to keep in the forefront the fact that the 18 classrooms we observed are just such classrooms—classrooms populated by students eligible for free lunch support in schools that have a history of slipping on and off academic warning lists. Many of the teachers observed were new to teaching or to first grade and several expressed their lack of knowledge of or comfort with technology.

In this environment, we feel that our study documented several factors that make us optimistic about the potential and promise of literacy technology such as Innovations for Learning for improved literacy learning for these students, besides the academic improvement noted in the preceding section. The first factor is the incredible enthusiasm engendered by the technology in both the teachers and the students. Students were engaged even at the end of the year and teachers, often a most critical group, were very positive about the utility of the programs and their students' responses. Unlike many technology programs that are skill-and-drill without any fun, basically workbooks on a screen, the IFL materials, besides being theoretically sound, are also engaging and seem to have staying power with the class.

The enthusiasm of the teachers was also paired with developing comfort on their part with technology. Besides those who admitted to being technophobic, there were others who had little or no technology work included in their curriculum prior to

the introduction of this literacy technology. A new openness to technology and what it could do was exhibited on the part of the teachers in their comments. The one teacher who noted that she could never have given the students the individual attention to match the on-level work they were doing on the computer spoke for many in this regard. We saw inroads being made on using the information for conferencing, using the printable books for take-home, and other indications that teachers were beginning to integrate this technology into instruction that did not reside in an independent center.

Secondly, the literacy technology provided a well-designed, productive center that enabled differentiation. Not only were the lessons and the structure of the technology differentiated, but the existence of the center allowed teachers to undertake more flexible grouping with their students because they had the time to work with smaller groups of students. Even small successes with grouping and differentiation bring teachers into the conversation about dealing with the learning diversity of their students. Teachers who were totally stymied about group work found that the support of the technology center, with its four to five computers, allowed them to begin to investigate the process.

Third, the learning technology allowed students to develop independent work habits and to build both their skills and confidence about literacy and about using technology. Both teachers and students commented on the fact that they saw skills, focus, attention, and confidence being built. Several teachers noted that students who did not exhibit much attentional control at the start of the year were able to attend at the technology center and felt that the students then became more able to focus in class. In particular, the ELL students and their teachers felt that they were conscious of their own learning from the program and also commented on this in class and connected their computer work to their class work.

And, finally, students showed significant gains in their literacy skills on standardized measures even in classrooms and schools that were not exemplary. Significant learning took place even in what one might consider a “worst case” use of the literacy technology; it was in its introductory year for most of the classrooms in which many teachers were new and/or not comfortable with technology and who used the technology primarily as a free-standing

center. Though these may be attributed to the novelty of new technology, we feel that they amply demonstrate the possibility of giving even limited access and support to teachers and students in at-risk schools.

There are several recommendations that we believe may increase the potential for this technology in primary classrooms:

- Examine the use and usefulness of data to inform instruction. Four of the teachers were beginning to investigate the data collected by IFL but found the data difficult to connect to their instruction. There should be some collaborative work undertaken between software designers and teachers to look at which data are collected and the way the data are collected and displayed. This would be productive for both sets of partners.
- Connect the IFL lessons more closely to the curriculum. One teacher had undertaken a charting process to connect lessons with the curriculum as presented in the core literacy program. There are some concordance charts available in the IFL materials, but they are either not understood or are not used by the teachers, another question for investigation.
- Develop the writing component of the program and encourage teachers to implement classroom writing activities as part of their literacy instruction. One outstanding observational finding was that we saw no writing instruction in any of the classrooms we visited, nor did many of the classrooms have writing centers or even writing materials; i.e., pencils, crayons, paper, etc. This is obviously an area ripe for development.
- Engage the literacy team leader of the school to help connect and integrate literacy technology into the curriculum. Even with superb technology support, many of the teachers displayed a lack of understanding of the ways in which the programs could support the district reading initiative or the basic instructional goals of early literacy classrooms. Having the literacy team leader of the school engaged in the project would enhance both teacher and student learning and provide ongoing input to the technology coordinators about literacy.

In this investigation, we found many ways in which literacy technology in the classroom appeared to enhance the literacy learning and teaching in first-grade classrooms as well as students'

interest in school learning. With at-risk students who are often unmotivated, we saw proof of the quotation, "Knowledge is power and enthusiasm pulls the switch." There are many issues related to technology and its uses in primary classrooms that are ripe for inquiry and we hope this research will add both some knowledge and enthusiasm for future endeavors.

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Appendix A: Classroom Literacy Environment

School _____ Teacher _____ Date _____

Number of students _____

First Grade Literacy Environment Checklist Date _____

School _____ Teacher _____ Observer _____

Use columns to make comments to explain rating if needed

| | 0 None | 1 Some | 2 High |
|--|--------|--------|--------|
| Labels | | | |
| Children's work displayed | | | |
| Visual reminders of routines, directions, schedules | | | |
| Posters focusing on literacy | | | |
| Books for independent reading | | | |
| Magazines and other reading materials (catalogs, comics) | | | |
| Games requiring reading | | | |
| Writing materials: paper, writing implements | | | |
| Word or vocabulary wall | | | |
| Reading corner or spot for comfy reading | | | |
| Writing corner, center, or spot | | | |
| Classroom layout is conducive for variety of groups | | | |
| Books are displayed for motivation | | | |
| Computer center with reading software | | | |
| Listening center with books | | | |
| Letter charts | | | |
| Phonics (letter sounds) charts | | | |
| Overhead | | | |
| TV | | | |
| CD | | | |
| Rug or meeting area | | | |

Appendix B: Classroom Time Sampled Observation Sheet

Observer _____ School _____
Teacher _____
Date _____ Student's first name _____ Gender _____
Start time _____
Check all that apply and so on for 120 minutes.

| | | | | | | | | | |
|----|--------------------|-------------------------|--------------------------|---------------------|----------------------|----------------------------|-----------------------------|------------------------|-----------|
| 5 | Student Teacher | Text read Directions | Text writ Wh Grp inst | wsht Sm Grp inst | Computer Ind inst | Other center Management | Group s/p/i/w Assessment | Task On/off IFL ref | Comments: |
| 10 | Student Teacher | Text read Directions | Text writ Wh Grp inst | wsht Sm Grp inst | Computer Ind inst | Other center Management | Group s/p/i/w Assessment | Task On/off IFL ref | Comments: |
| 15 | Student Teacher | Text read Directions | Text writ Wh Grp inst | wsht Sm Grp inst | Computer Ind inst | Other center Management | Group s/p/i/w Assessment | Task On/off IFL ref | Comments: |
| 20 | Student Teacher | Text read Directions | Text writ Wh Grp inst | wsht Sm Grp inst | Computer Ind inst | Other center Management | Group s/p/i/w Assessment | Task On/off IFL ref | Comments: |
| 25 | Student | Text read | Text writ | wsht | Computer | Other center | Group s/p/i/w | Task On/off | Comments: |

Appendix C: Teacher Interview

School _____ Teacher _____ Date _____

Interviewer _____

We are interested in finding out how first-grade teachers use the IFL program and how your teaching, grouping, or assessment might have changed since you began using the program.

-
1. How long have you been teaching first grade?
 2. How long have you used the IFL program?
 3. Tell me a bit how you use the IFL program in your classroom? (How often? When?) How do students use the program? Who can use the program? Is any student required to use the program? Any not using it? Why?
 4. What do you think the IFL program does for first graders learning to read?
 6. Does the program align/fit in with your reading and writing program? How? (Probe using CRI: word study [phonics, comp. writing, independent reading])?
 7. Since you started using IFL in your classroom, has anything changed in the way you teach reading? (get an example). Has it changed your attitude toward teaching?
 8. Since you started using IFL in your classroom, has anything changed in the way you group for reading? (get an example). Ask about center use
 9. How do you use the information about students that you get from IFL? Can you give a specific example?
 10. Do you see any transfer between what the students do in IFL and what they do in the rest of your program? Give an example.
 11. Are your students motivated by and engaged in IFL (or by computer instruction)? How do you know? (example) Is there any student for whom it does not work? Explain.
 12. If you were talking to another teacher who is considering using this program, what would want to say about IFL?
-

Note. CRI = Chicago Reading Initiative.

Appendix D: Student Interview

Remember to ask teacher how they refer to IFL and use that term when talking to students.

Date _____ School _____ Teacher _____

Interviewer _____

Student's first Name _____ Gender _____

IFL student interview: When your target student uses the IFL program, go sit by them and

Give a brief description of the lesson or task they are doing

1. Can you tell me what you are doing?
2. What are you learning (in this lesson)?
3. How can this (lesson) help you when you read or write?
4. Do you like this (lesson, game)? Why? Why not?

Repeat as you observe shifts

Give a brief description of the lesson or task they are doing

1. Can you tell me what you are doing?
2. What are you learning (in this lesson)?
3. How can this (lesson) help you when you read or write?
4. Do you like this (lesson, game)? Why? Why not?

When student leaves, ask

5. Do you like using this program? Why? Why not?
6. What do you like best?
7. Pretend you are playing school with a kindergartener. How can you use _____ to help them learn to read; to write?