Running Head: Integrating Nonfiction Reading

Integrating Nonfiction Reading with Instructional Technology in the Classroom: Evaluating the Effects of K-3 Reading Reform in Illinois

Elizabeth J. Oyer, Ph.D.

Evaluation Solutions

Emily Alford, Ph.D.

Area IV Learning Technology Hub

Phyllis Hostmeyer

Madison County Regional Office of Education

Kathy Massey

Area IV Learning Technology Hub

Vicki DeWitt

Area V Learning Technology Hub

Abstract

This report summarizes the evaluation of two inquiry-based nonfiction reading projects in Illinois. Changes in classroom practices, student outcomes including reading gains, and the influence of technology on these changes are presented. Teachers rated their levels of use of various software including KidPix, WiggleWorks, Graph Club, and Read, Write, and Type. Finally, sustainability factors as described by participating teachers are discussed as well as methodological limitations of the analyses that were conducted.

Integrating Nonfiction Reading with Instructional Technology in the Classroom: Evaluating the Effects of K-3 Reading Reform in Illinois

Conceptual Framework

Everyone is clamoring for results and accountability. Literacy and reading gains are foremost on the list of student outcomes that educators are scrambling to address. The idea of inquiry-based learning as a tool for improved content knowledge (e.g., in science or social studies) is not new. However, the notion that an inquiry based curriculum could improve student reading achievement may not be readily apparent. In order to understand how an inquiry unit could be related to reading, it is important to develop a clear picture of inquiry based learning. Inquiry is not a strategy; inquiry is not a method. Duvall (2001) refers to inquiry as "a philosophical stance an educator takes…one that uses these students' questions to frame curriculum rather than only to assess students' mastery of curriculum…" (DuVall, 2001, p. 3). But what does inquiry process look like in a classroom? Sullivan (1999) utilizes a four-part model in her classroom: raising questions, searching multiple resources, grouping to integrate information, and sharing conclusions. On the other hand, Short, Harste, & Burke (1996) relate inquiry to the cyclical authoring process. They believe that inquiry begins with what the student already knows: personal and social knowledge. From this knowledge, students are given time to ask questions and gain new perspectives collaboratively. This includes recognizing and reconciling differences and culminates in sharing new knowledge, taking action, and planning new inquiries.

Support for the effectiveness of inquiry based classrooms is widespread. Palinscar, Magnusson, & Cutter (2002) state that, "Virtually all contemporary educational reform documents call for the teaching of science to be inquiry based" (p. 88). Worthy (2000) cites

research that points to the waning interest in reading, writing, and school in general once children reach the intermediate and middle grades. She asserts that those student attitudes toward school will improve when students are provided a wide variety of interesting books and given choices concerning the projects in which they will participate. Cambourne (2001) also speaks to the importance of student engagement. Teachers can model learning and provide materials but if the students are not convinced that reading is worthwhile, they simply will not read. The model of reading presented to the student must have a purpose to which the student can relate. Purposeful tasks and authentic connections are crucial elements of the inquiry based classroom. Finally, Drayton and Falk (2002) cite three truths about science education which they feel make inquiry based classrooms a necessity. We are experiencing an exponential growth of science knowledge, that knowledge is not an indisputable set of facts, and the subject matter is diverse. Because of the nature of science, teachers cannot expect to impart a body of knowledge that will serve students for life. Students must be taught how to ask questions, and research responsibly to find the correct answers.

Clearly, support for the inquiry method exists, and that body of research plays an important role in "selling" the teachers on using the inquiry method. The second hurdle lies in convincing teachers that students can and will read non-fiction text. In a study of first grade classrooms, Duke (2000) finds a serious scarcity of informational text in classroom libraries or on classroom walls. In addition, he reports a mean of only 3.6 minutes per day spent with informational texts during classroom activities. As students progress to higher grade levels their exposure to non-fiction text increases. Because the structures of informational text vary from those of narrative text, primary students need exposure to non-fiction to build the skills needed to read these types of texts fluently in later grades (Yopp & Yopp, 2000). The belief is widespread

that a child's ability to understand fiction precedes the ability to understand non-fiction. Several researchers (Yopp & Yopp, 2000; Duke & Kays, 1998; Pappas, 1991) suggest that young children possess the ability to understand informational text as well as fiction. They also caution that if students are not provided opportunities to interact with informational text, this ability will fade. A lack of informational text in school libraries and teachers' attitudes about the use of nonfiction are contributing factors in the low levels of informational text use in the classroom. So the question remains, can inquiry units utilizing nonfiction texts improve students' reading achievement? This study addresses this question in the context of two projects, the K-2 Reading Project in the Illinois Learning Technology Hubs of Areas IV and V.

Methodology

Inquiry Intervention for Both Projects

The model for student inquiry used by these two projects is built on the body of research and theory on inquiry-based learning (Alford, 2000). First, students must encounter the issue. Next they must define the parameters by explaining the task and asking pertinent questions. Students then begin to investigate and gather information. They then reason with the information and make decisions before designing a final product. As they share the final product, opportunities to make decisions arise again. The Alford (2000) model shows inquiry happening in phases and focuses on the importance of prior knowledge, student questions, research and sharing. The professional development model trains teachers over the course of four days with two over-arching themes.

Phase One: Two-day training in inquiry-based learning

Professional development and student objectives:

1) Restructure existing science or social studies units

2) Increase student achievement in science or social studies

3) Develop student literacy skills in the use of technology

Participating teachers develop inquiry-based learning units that hold students accountable for basic skills and concepts while challenging them to understand how content applies to real-life issues. Students tackle the conceptual themes and big ideas in science and social studies in addition to mastering factual information.

In these engaged learning units teachers (1) pose relevant problems to learners; (2) use "big ideas" and concept-based curriculum to structure learning; (3) employ technology to access, organize, analyze, and report information; (4) link local required curriculum to Illinois Goals and Standards; and (5) value student decision making and points of view. The workshops help practitioners restructure existing required curriculum units using strategies that support student inquiry, the use of technology, and application of required content into a culminating project or product.

Phase Two: Two-day training focusing on reading in the content areas

Professional development and student objectives:

1) Increase student achievement in reading comprehension

2) Utilize reading strategies outlined by Stephanie Harvey in developing lesson plans

All achievement tests in science and social studies are measures of content knowledge as well as reading comprehension. During this workshop, participating teachers learn to extend reading comprehension strategies into the more challenging text found in science and social studies materials. Trade books and materials ordered for the unit are used as resources for developing reading lesson plans. These content-focused strategies assist students to:

- consciously utilize text structures to guide interpretation and understanding of expository text

- use QAR (question and answer relationships) to locate and analyze information from text materials
- employ summarizing and note-taking skills to delete trivial information, select key ideas and facts, and generalize concepts into their own language
- communicate using visual text structures (maps, diagrams, time lines, graphs, tables)
- learn to monitor comprehension by using metacognitive strategies
- merge their understanding of scientific principles and processes with the meanings they have derived from what they have read
- summarize what they have read in an appropriate written format

Participants

Area IV

There were thirty-six (36) kindergarten, first, and second grade teachers from eight (8) schools in Area IV who participated in evaluation activities.

Area V

There were up to teachers and students from 25 schools participated in the evaluation activities (see Table 1 in Appendix A for sample sizes by data source).

Data Sources and Analysis

Area IV

1) Teacher Survey

In the fall and spring, all participating teachers completed a survey addressing classroom teaching and instructional planning processes and how technology has influenced these practices (see Appendix B).

Descriptive statistics and Chi Square tests were used to measure trends and changes based on the teacher survey. For the focus group data, a constant-comparative method of analyzing "chunks of meaning" was used to identify themes in the narrative data. Almost 400 individual “chunks” were coded according to the original interview protocol categories: implementation issues, support/training issues, sustainability issues, and student outcomes. Content analysis revealed several themes within each of these major areas.

2) Teacher Focus Groups

In the spring, twenty-two (22) teachers participated in small group (four to five teachers per group). The discussions surrounded implementation and sustainability issues as well as observed student outcomes (see Appendix C for Focus Group Protocol).

Focus group transcripts – twenty-three (23) teachers participated in focus groups with their team mates. Focus group transcripts were analyzed for emergent themes related to student reading outcomes, other student outcomes, and sustainability issues.

Area V

1) Unit Implementation Logs

Teachers completed logs at the conclusion of each unit. These logs included duration of the units, technology integrated into the units, reflection on the strategies used in the unit, observed student outcomes, and reporting of student outcomes.

2) Training Evaluation

Teachers completed a seven-item training evaluation at the end of the year (see full text of survey in Appendix D). Descriptive analysis of Likert items and content analysis of open-ended responses were conducted. Factor analysis of three Likert items revealed one strong factor

for all three items (77% of variance accounted for by one factor) with a strong internal consistency indicated by α=.85.

3) Technology Evaluation

Teachers completed four open-ended evaluation of all software used in their units (see Appendix E for full text of items). Content analysis of responses was conducted.

4) Focus Groups

The evaluator conducted small group (four to six teachers per group) focus group session in the summer (see focus group protocol in Appendix F).

5) Reading Achievement Test Scores

Technical problems prevented the use of the planned testing for reading changes from fall to spring. Four cases are described where schools utilized ISEL and ITBS data appropriate for analysis.

Results

1. How have teachers changed their classroom practices in response to the training and resources provided by the project?

Significant Changes in Classroom Practices

Changes in classroom practices were measured by a survey on two constructs: inquiry/constructivist practices in the classroom (3 point scale) and influence of technology on these same classroom practices (3 point scale including N/A option).

Because the items did not contain the same response stem, it was crucial to establish that the items truly formed a single "subscale" or "construct" before summing the nine items and using an average score to measure for differences. A factor analysis of the nine survey items

indicated that there were four distinct factors or subtests and these factors changed between the pre- and posttest. Therefore, summing the items was eliminated as a means of analysis.

To measure the overall changes in classroom practices, Chi Square tests for differences between the pre- and posttest frequencies of teachers reporting each of the nine practices were conducted (see Table 2a – 2j in Appendix G).

Influence of Technology on these Practices

Teachers reported the level of impact technology had on various classroom practices. While there was only one statistically significant few changes in the influence of technology on the teachers' practices, a majority of teachers were already reporting that technology increased these practices at the pretest (see Table 3 in Appendix H).

There were three exceptions to this trend: higher order thinking tasks, assessments with multiple dimensions, and collaboration with students on planning assessments. The one significant change from pretest to posttest was on the practice of creating tasks that required higher order thinking by students. The proportion of teachers reporting that technology increased this practice rose from 40% at the pretest to 68.75% at the posttest (χ^2= 6.173, df=2, p<.046).

2.What changes have teachers observed in their students as a result of training and resources provided by the project?

Content analysis of the focus group transcript related to student outcomes revealed three themes: assessment strategies, reading outcomes, and motivation outcomes. When asked about student outcomes, teachers described the projects and assessment strategies they used to measure their students' understanding. About one-third of all "chunks" analyzed from the focus groups related to student outcomes in some way. Teachers talked specifically about student reading

gains and increases in student motivation and interest in reading as well as specific strategies they used to measure student understanding (full text of focus groups available from first author).

Changes in Students' Reading

Direct measures of reading achievement changes were not completed for this evaluation. Initially, the analysis was planned to compare two K-2 Reading classrooms with a comparison group using 2000-2001 ITBS scores as a covariate and comparing students' 2001-2002 ITBS Reading scores. Unfortunately, the participating teachers did not start their units until after the testing, making the comparison in-valid.

Many teachers reported improved reading and writing that they attributed to this project. The main assessment tools teachers valued for measuring student outcomes were portfolios, written work, and unit projects.

> "I did [DRA testing] on my own…I did it the first week of school …and I did it at the end of school ... Everyone moved levels. I'm bragging but – I had a little boy start at Level 3 and I gave up all my title time for about two months so that he could do the reading skills and he finished at Level 30" (Teacher Comment #100).

> "I witnessed them using vocabulary. We didn't say cocoon, if it's a moth it's a cocoon and they would say, 'but, you know, if it's a butterfly it's a chrysalis…'"(Teacher Comment #137).

> "You should see some of the writing that her children do – it's excellent" (Teacher Comment #224)

> "There is no real good way to tell you that I feel like my students grew in that way, except just to say that even my low readers were really taking those books and getting facts from them, and using the facts. They did not always do that, for instance, on our local assessment they have a fiction story that they read on their own and they have to answer questions on their own and there wasn't the enthusiasm there that there was when they were doing the inquiry" (Teacher Comment #483)

Changes in Students' Interest and Motivation

Teachers reported across the board that students showed increased enthusiasm, motivation, and interest in reading, writing, and use of the new reading software.

> "My class was very difficult this year - very, very difficult. I had a lot of boys who decided they did not have to work…But, when I introduced the machine unit…Even the ones that skipped school a lot showed up during that unit. I was really amazed…It was like I was working with a whole different group of kids" (Teacher Comment #27).

> "They were so involved and they were so excited. I mean, they really took ownership of the unit which made it a whole lot easier to teach, especially when I was teaching brand new strategies. I mean, they were just soaking it up and they couldn't wait to get to those books with real pictures so that really helped a lot" (Teacher Comment #476).

> "Well…we had live insects…so we raised the butterflies and they enjoyed logging each day or every couple days the differences they say. They drew excellent pictures. Then they got to help in releasing the butterfly. Every time we brought out a new book or a new activity or a new manipulative they were excited. We had their attention" (Teacher Comment #131).

Assessment Strategies

Teachers use a variety of assessment approaches including portfolios, books and murals to demonstrate and evaluate student understanding.

> "Our life-sized display was real impressive. It was a huge wall…and the parents just loved it… The newspaper came in…We collected money to save the rainforest and we actually ended up with 17 acres that we …" (Teacher Comment #389).

> "And they became very good at asking questions"(Teacher Comment #310).

> "And I think a lot of the assessments that we tied into our project, it's not like giving them a test, but it's an assessment that you observe whether they have an understanding of what you're teaching…Maybe doing a book on the sequencing of butterflies

> and the life cycles or …A "T" chart, insect/non-insect. Or they color/cut and paste – they are being active but they still had to use the information or the data that they learned from the books to get things in the right category" (Teacher Comment #163-166).

4. What are the sustainability issues for continued implementation of inquiry-based units into curriculum?

The main factors in sustaining the integration of inquiry units into the curriculum revolved around the issues of money for needed resources, time for unit development, and opportunities for networking with other teachers. Teachers had creative ideas for addressing some of these needs (like sharing materials within a building and using available professional develop days for writing units with other teachers). However, an important element emerged related to these needs: the importance of support and "buy-in" by administrators. Teachers described the need for:

More Resources

> "We need money for classroom libraries because our library orders books and we do not. There is no money for us to put books on our shelves" (Teacher Comment #91).

> "The problem is having enough books…At first there were no good non-fiction books for first grade but it's so expensive to get enough books for each unit that I have to teach – that's the hard part" (Teacher Comment #220).

> "So if you go through the training then you will be allowed to check out [an 'inquiry unit kit'] and that might encourage people to attend sessions to get the mentoring and the background information they need in order to use those resources. So even if they can't own them, just to be able to use them might also be enough incentive"

More Time

> "They tell us we have to have so many periods a week of teacher work time but it's not true. I mean, yes, you have 25 minutes when your kids go to PE but by the time you take them down there, stand in line waiting to transition them, walk back to your room you now have 15 minutes left" (Teacher Comment #190).

> "Definitely time – because your curriculum is set. I love to teach inquiry-based units but I need to build them around a curriculum that is already set in my school …So, if you are going to ask me to write a whole unit like this, I'm going to need either time or a stipend for my time to be able to do that and then money to buy the materials…" (Teacher Comment #493).

More Networking

> "But, having the experience of coming down here, meeting other teachers, knowing what they're doing and that it worked in their classroom gives you the 'whatever' to go back and try it in your own room and…Just knowing what's going on in other schools and other grade levels and the opportunity to come here…" (Teacher Comment #259).

> "But if they would allow the grade levels to meet and develop something like this, there's not a teacher in our group who wouldn't contribute to this. When four or five of you are sitting there and you point out ideas like this – you could whip up these units in that afternoon time frame" (Teacher Comment #272).

Administrative Support

> "You are going to have to get into the school districts and you are going to have to let principals see" (Teacher Comment #658).

> "I think number one is to get more teachers aware. I was very fortunate because everyone in our first grade team teaches about the same way but if you are in a district where you are one of four and you are the only one who has done this concept and your already struggling to get it started then you have to overcome the principal and the other three teachers, not to mention your curriculum. So, there I think you would have head to head frustration in several different areas" (Teacher Comment).

> "That's the difference, because when you're believing in what the activity is then the purpose behind it is different on those days than when you are forced to choose something that you don't think is going to make a change so then you are just logging your time" (Teacher Comment).
>
> "That is what we are doing at our school. Every school …is picking some type of model…and we do units and we do them according to our grade level but it's not set up the way [Emily Alford] does it. This makes sense – it's under reading basis and all that – but the way we do our units [in our school district] are so backwards they don't make any sense. It's like people are doing them just to get them done where these are totally different" (Teacher Comment).

5. How was technology rated by the teachers?

Teachers' responses to open-ended questions about their integration of technology were coded and summarized for all software. In some cases, teachers' responses could not be coded because they did not give specific details of use. For instance, in response to the question how often did you use this software, some teachers replied "As often as possible."

<u>WiggleWorks</u>

Over 70% teachers integrated Wiggleworks into their curriculum in some way (n=62; $n_{invalid}$=4). Of these teachers, just under half (43.5%) reported using Wiggleworks 1-2 times per week and 24.2% reported using WiggleWorks every day (see Figure 1a in Appendix I). Teachers' comments indicated that the software, once installed, was used throughout the year—even outside the context of the unit developed for the project.

Teachers described integration of Wiggleworks primarily into reading or language centers in their classrooms. Integration ranged from students only reading or listening to stories to fully utilizing the software through reading or listening to the books followed by writing about

the books as using the "magnet board." Full text of teacher comments about integrating all technologies are available from first author.

Finally, 92% (n=59) of teachers recommended purchasing WiggleWorks again. Comments suggest that this program may be more suitable for kindergarten through second grade (see Figure 1b in Appendix I).

KidPix

The use of KidPix was much less consistent than the use of WiggleWorks. While about 80% of teachers reported integrating KidPix into their curriculum in some way (n=74), the level of use was nearly equally split in three categories: low usage (defined as only a few times), moderate usage (1-2 times per week), and high usage (3-5 times per week; see Figure 2a in Appendix J). In addition, several teachers' comments seemed to indicate that the software, once installed, was used specifically for the K-3 unit developed for the project and not consistently extended beyond this use.

Many teachers described using KidPix to create final products for their units. This included having students write pages for books and inserting clip art and pictures to go with their writing (see Appendix G for full text). It should be noted that many teachers also indicated they were unable to use KidPix effectively because of technical problems (it is not clear whether the system requirements were the root cause or incorrect installation).

Finally, 88% (n=75) of teachers recommended purchasing KidPix (see Figure 2b in Appendix J). Comments again suggest that there are important system requirement issues and training needs before this software is useful to teachers.

Read, Write, and Type

Half of the teachers using Read, Write, and Type indicated they used the program about one to two times a week (see Figure 3a in Appendix K). About one third of the teachers indicated low use of the product, one to two times per month or only a few times throughout the year. Few teachers used the program every day.

Teachers described their integration of Read, Write, and Type into their curriculum primarily as independent work for students. Some teachers used it regularly during lab times but many teachers indicated that it was a "formal" part of their curriculum. Those teachers who did integrate it more fully into their activities were positive about the phonics and typing aspects. Some teachers indicated that students had been exposed to it in earlier grades making it less useful in their classroom.

Most teachers (95%; n=20) who responded to the question about purchasing Read, Write, and Type again were in favor of the product (see Figure 3b in Appendix K).

GraphClub

Most teachers used GraphClub infrequently (one to two times per month or only a few times). About equal numbers of teachers used the product daily or one to two times per week (n=5, 12% and n=6, 15% respectively; see Figure 4a in Appendix L).

Teachers integrated GraphClub in a variety of ways both within and beyond their inquiry units. Students graphed the weather, animals, birthdays as well as used the program during free time.

While descriptions indicated teachers enjoyed using GraphClub, other comments suggest that teachers were more willing to "give it up" compared to the other technologies (see Figure 4b in Appendix L).

6. What were the outcomes for K-3 students?

Because of technical problems with the planned reading instrument (Keys2Reading), the tests for reading changes from fall to spring were not conducted. Student outcomes were investigated using available data from participating schools, focus group data, and survey data.

Elementary School #1

There is preliminary evidence that K-3 kindergarten and first graders achieved higher reading scores on the ISEL (Illinois Snapshots of Early Literacy) test compared with students who did not participate in the program.

A Chi Square Test of Independence was conducted to determine if the number of students achieving scores below 130 (the school's cut-off for reading services) and above 130 was different for students in the K-3 program and comparison classes in the same school.

Table 4 in Appendix M shows the observed and expected frequencies (in parentheses) assuming no relationship between score category and participation in the K-3 program. The resulting $\chi^2 = 25.49$ is significant with $p < .0001$. Non-K-3 students achieved more scores below 130 and fewer scores above 130 than expected. K-3 students achieved fewer scores below 130 and more scores above 130 than expected if there was no relationship (see Figure 5).

For first graders, there are three scoring categories for comparison of the K-3 and non-K-3 students. For these students, a score below 155 indicated need for Title 1 services and reading instruction while a score of 155-160 indicated a need for supplementary reading instruction.

Table 5 in Appendix N shows the observed and expected frequencies (in parentheses) assuming no relationship between score category and participation in the K-3 program. The resulting $\chi^2 = 5.5$ is significant with $p < .02$.

Non-K-3 students achieved more scores below 155 and fewer scores above 160 than expected. K-3 students achieved fewer scores below 155 and more scores above 160 than expected if there was no relationship (see Figure 6).

Elementary Schools #2 and #3

These elementary schools provided data from two test administrations: the Illinois Snapshots of Early Literacy (ISEL) and the Developmental Reading Assessment (DRA). Analyses of these data included tests of gains from pretest to posttest on four ISEL subscales and gains in reading level from pretest to posttest on the DRA for kindergarten and first grade students. All analyses were conducted on K-3 reading students only; there were no comparison student data.

Analyses of the ISEL scores indicate that students made significant gains from the pretest to the posttest on the four snapshots (missing data precluded analysis of snapshots 5-8). Tables 6a and 6b and Figure 7 in Appendix O shows the results of four paired T-tests and the resulting p levels (adjusted for multiple comparisons).

The non-parametric Wilcoxon signed-rank test was employed to test for differences between the pre- and post-DRA reading levels. The Wilcoxon signed-rank test considers information about both the sign of the differences between the pre- and posttest (i.e., whether the pretest is greater than or less than the posttest) and the magnitude of the differences between pairs (i.e., ranking the differences between all the pairs).

The analyses shown in Tables 7a and 7b in Appendix P indicate that the students' posttest reading levels were significantly higher than their pretest levels ($z=10.345$; $p<.0001$).

In the analysis, 498 pairs of scores were compared at the pre- and posttest. Only one pair showed the student with a higher level on the pretest than on the posttest. There were 57 ties,

indicating that 57 students ranked the same at the pre- and posttests. The remaining 440 students showed an increase at the posttest over their pretest ranks. These increases were of varying degrees and resulted in the significant z statistic that was computed.

Elementary School #4

Second graders at Salem who participated in the K-3 Reading program were compared with a random sample of students from a rural school district in central Illinois. First grade ITBS scores for both the K-3 and Comparison students were used as a pretest, or covariate, in the analysis.

Tables 8a – 8c show the results of the ANCOVA analysis. The groups were different on their pretests with the differences on the covariate significant at $p<.0001$ (see Table 8a in Appendix Q). This indicates that the Grade 1 scores were important to include in the analysis as covariates. Though the K-3 Grade 2 Reading NCE was higher than the Comparison Grade 2 NCE, the difference was not significant with $p<.077$ (see Tables 8b and 8c in Appendix Q).

Focus Group and Unit Implementation Log Reports of Student Outcomes

When teachers wrote or spoke of student outcomes, four general themes emerged. (1) Teachers spoke of the attitudinal or motivational outcomes they observed in their students. These included comments about students' interest and excitement about the units and as well as reading nonfiction books.

> "The students became very excited about the ocean and the different things that are in and that make up the ocean" (Teacher 156, Unit Implementation Log).

> "The students get really excited, like when they come to the lab, I'll have some out there for some out there for other grades …and they'll come and even if it's not their turn to use those books, they're going through them …and they just say, 'can't we do it?' So they do, they get excited about it" (Teacher Comment 17, Focus Group Transcript).

> "I do have one student though this year that it was hard to keep his interest but once we got into the nonfiction, he was mesmerized. And his behavior improved…He was excited…" (Teacher Comment 719, Focus Group Transcript).
>
> "It is and because the children are excited. You go in and see all those little smiling faces and their all excited about the things that you're doing so…'(Teacher Comment 762, Focus Group Transcript).

(2) Teachers cited improvement in students' level of engagement, ability to work independently, do research, and work collaboratively.

> "This was a great unit! Kids are still bringing in articles, books, etc. about the ocean even tho we finished it 2 months ago! We learned how to find info in books by using index, contents, etc. We learned to find interesting facts" (Teacher , Unit Implementation Log).
>
> "The students are more independent workers, and some of the students have learned to become natural leaders in the classroom. They love nonfiction books" (Teacher 100, Unit Implementation Log).
>
> "…the new word for about two weeks was research. 'I did some research, I did some research.…' And they'd get down with the books and they'd look and they'd have a little paper and pencil there and they'd be writing down facts about what they…read. And they got real excited to share with each other…" (Teacher Comment 21, Focus Group Transcript).
>
> ".... I thought for the most part it would work but you'd still have those five or six that couldn't keep and that…that never happened. Because I would always find that other kids would take 'em under their wing. And even when they were kind of wandering around aimlessly somebody else would call them into their group or give them a specific job (Teacher Comment 378, Focus Group Transcript).
>
> "They became more responsible for one thing about what they were learning. They wanted to do…they wanted to go over and find facts out of books all the time and record them and they

> wanted to collect their findings and then tell everybody…" (Teacher Comment 555, Focus Group Transcript).

(3) Teachers also talked about gains in content-knowledge specific to the unit of study.

> "….the biggest difference I noticed was that the students had a much deeper understanding of the subject matter…" (Teacher 33, Unit Implementation Log).
>
> "The children know cycles [from Rocks and Soil Unit] and are always coming up with new ones…" (Teacher 89, Unit Implementation Log).
>
> "Students gained a wealth of knowledge about farm animals, crops, and machinery. Students could read many nonfiction books independently. Students created many fact related stories about farm animals, crops, and machinery…"(Teacher 122, Unit Implementation Log).
>
> "…going back to whatever you use the nonfiction books, you're using something they're interested in. That makes them want to learn more, which makes them comprehend whatever the field you're working on, makes it really easy for them to do because it from the real world…" (Teacher Comment 47, Focus Group Transcript).
>
> "I think a lot of it has to do with the fact that most of the nonfiction units are leveled so you see all of your students experiencing success….I just get so excited when I see that struggling reader be able to go over and pick up a book and learn a fact or something on their own…I had kids barely reading books this year and they're like, 'It looks like these plants make their own food. They use the leaves to do it.' And I'm thinking these kids are six years old, you know, that just blows my mind that…they're reading and learning those things…" (Teacher Comment 797, Focus Group Transcript).

(4) Finally, teachers spoke of gains in language arts, including increased vocabulary, questioning, writing ability, and increases in reading level.

> "I saw developing vocabulary as one of the largest gain in the project. I was so pleased at their ability to recall the

> vocabulary for example metamorphisis and the meaning of each word and how it applied to the content area of study" (Teacher 83, Unit Implementation Log).
>
> "I felt this unit played a major role in the progress my students made this year. Their computer skills were definitely improved, and I was amazed at the reading and writing levels of most of my students. I felt it really helped to make my students think" (Teacher 79, Unit Implementation Log).
>
> "…And I really feel my reading's improved, my teaching of reading's improved and the kids are reading and writing in my grade more than they ever did before, a lot of writing…And the librarian said to me last year and she said to me again this year. Your kids are always looking for nonfiction books, so, that made me feel good" (Teacher Comment 793, Focus Group Transcript).
>
> "The Title 1 kids were wanting to read more and better sentences, their writing was a lot better. You can tell…and they were bringing in material from home…students that would never do that were bringing in material from home so…" (Teacher Comment 280, Focus Group Transcript).
>
> "Yeah, there was a very, very big gain in ISEL scores…reading and comprehension together" (Teacher Comments 304-306, Focus Group Transcript).

Student Outcomes Linked to Technology

For WiggleWorks, teachers cited improvements in computer skills, writing, reading, and enjoyment of reading (see Appendix I for full text of teacher responses).

> "Students became more familiar with the computer. They were able to read most of the stories fairly well, but were able to get help when they needed it to decode a word. Their writing skills improved" (Teacher 19, Technology Survey).
>
> "growth in reading as demonstrated by the STAR test" (Teacher 117, Technology Survey).

> "I noticed an improvement in the students' writing (in punctuation, capitalization, grammar, and developing a story line)" (Teacher 85, Technology Survey).
>
> "Improved reading and writng skills. Improved use of the computer and working on their own at task board time" (Teacher 26, Technology Survey).
>
> "I noticed an improvement in some of the slow readers. Also, vocabulary improved. Some readers would relate stories from wiggleworks to classroom learning" (Teacher 106, Technology Survey).

Teachers' descriptions of student outcomes for KidPix focused on writing skills, unit content knowledge, and technical skills (like typing, downloading, changing backgrounds, and using textboxes).

> "Students became more skillful with the mouse, were able to create slides and edit for a slideshow" (Teacher 106, Technology Survey).
>
> "Students developed their writing skills. They became good at communicating their findings using this program" (Teacher 17, Technology Survey).
>
> "My students showed an understanding of insect parts. They were also able to describe and label the ant family and create a picture of an ant colony" (Teacher 99, Technology Survey)
>
> "Children became more familiar with the keyboard and the KidPix tools, practiced using correct punctuation and sentence structure, and creatively used KidPix art tools" (Teacher 130, Technology Survey).
>
> "Students used researched information to create various pages of a class book. Students were able to create their own text boxes, illustrations, and download various backgrounds. Students learned how to work the program very quickly" (Teacher 115, Technology Survey).

For Read, Write, & Type, teachers reported improvements in students' computer skills, decoding skills, and use of reading strategies.

> "My students were more confident finding letters on the key board. This program provided practice in phonics and reading skills, especially for low students" (Teacher 94, Technology Survey).
>
> My students loved this program. They improved their keyboarding skills. In the beginning of first grade it really helped to give them more practice with letter and sound recognition" (Teacher 26, Technology Survey).
>
> "The students began to be more fluent on the computer keyboard. They were using the strategies used in the software to decode words" (Teacher 16, Technology Survey).
>
> Increased knowledge of keyboarding skills. Students also became better with their decoding skills" (Teacher 17, Technology Survey).

Finally, for Graphclub, teachers who reported student outcomes noted students' improvement in making and reading graphs as well as better understanding of the usefulness of graphs for presenting information.

> "The students became more aware of the different types of graphs and ways to document information" (Teacher 54, Technology Survey).
>
> "They improved in making the graphs and in reading graphs" (Teacher 65, Technology Survey).
>
> "The children understood graphs better this year compared to other years. It helped them know various types of graphs for the Iowa Tests" (Teacher 81, Technology Survey).
>
> "I think it made comparing information clearer to my students" (Teacher 94, Technology Survey).

Discussion

Summary of Changes in Classroom Practice

Changes in classroom practices were measured by a survey on two constructs: inquiry/constructivist practices in the classroom and influence of technology on these same classroom practices. A factor analysis of the nine survey items indicated that there were four distinct factors or subtests and these factors changed between the pre- and posttest. Therefore, summing the items was eliminated as a means of analysis. To measure the overall changes in classroom practices, Chi Square tests for differences between the pre- and posttest frequencies of teachers reporting each of the nine practices were conducted.

The results of the analyses indicative several significant changes from the pre- to the posttest. Teachers increased collaborative planning of learning goals, tasks, and assignments with students. Teachers also increased the proportion of "real-world" tasks in students' activities. Though most teachers still only incorporated higher order thinking into some tasks at the posttest, there was a significant shift in the number of teachers requiring all or most tasks to be rooted in higher order thinking. Again, a slight majority of teachers still only used multiple dimensions for some student assessments, but a growing number involved self, peer, and teacher evaluations for most assessments. In addition, there was a clear shift away from the use of paper and pencil testing. Finally, more teachers incorporated modeling to teach students thinking processes, though they still relied somewhat on whole-class instruction.

Two practices remained unchanged from pre- to posttest, including the amount of time students spent in collaborative groups and the amount of time devoted to student exploration.

Teachers also reported the level of impact technology had on various classroom practices. While there was only one statistically significant few changes in the influence of technology on the teachers' practices, a majority of teachers were already reporting that technology increased these practices at the pretest. The proportion of teachers reporting that technology increased the extent to which students' tasks required higher order thinking rose from 40% at the pretest to 68.75% at the posttest.

Summary of Student Reading Changes

Direct measures of reading achievement changes were not completed for this evaluation. Many teachers reported improved reading and writing that they attributed to this project. The main assessment tools teachers valued for measuring student outcomes were portfolios, written work, and unit projects. Teachers reported across the board that students showed increased enthusiasm, motivation, and interest in reading, writing, and use of the new reading software. Teachers use a variety of assessment approaches including portfolios, books and murals to demonstrate and evaluate student understanding.

Summary of Student Outcomes

There is preliminary evidence that K-3 kindergarten and first graders from one elementary school achieved higher reading scores on the ISEL test compared with students who did not participate in the program. Chi Square analysis showed non-K-3 students achieved more scores below the 130 cutoff scores and fewer scores above 130 than expected. K-3 students achieved fewer scores below 130 and more scores above 130 than expected if there was no relationship between participation group and ISEL classification. The trend was the same for first graders.

NOTE: this analysis does not control for differences between students before the school year began. Because students were not randomly assigned to classrooms, it is unknown whether the non-K-3 students were significantly lower readers before the comparison.

Analyses of the ISEL scores from two elementary schools indicate that students made significant gains from the pretest to the posttest on the four snapshots (missing data precluded analysis of snapshots 5-8). For the DRA, the analyses showed that the students' posttest reading levels were significantly higher than their pretest levels (tested with Wilcoxon signed rank test).

NOTE: these analysis do not control for natural maturation and reading development that occurs for the student population as a whole. It is unknown whether these student gains were greater than could be achieved by alternative curriculum.

Second graders at a fourth elementary school who participated in the K-3 Reading program were compared with a random sample of students from a rural school district in central Illinois using their first and second grade ITBS Reading Total NCE scores. Though the K-3 Grade 2 Reading NCE was higher than the Comparison Grade 2 NCE, the difference was not significant with $p<.077$.

NOTE: a power analysis taking into account the differences in variability between the two groups (error variance) and the sample size needed to detect significant differences between the groups was not conducted prior to the analysis. Future analyses should consider power levels in determining appropriate sample sizes and setting minimally important effect sizes to maximize power and efficiency of the analyses.

When teachers wrote or spoke of student outcomes, four general themes emerged:

(1) Teachers spoke of the attitudinal or motivational outcomes they observed in their students. These included comments about students' interest and excitement about the units and as well as reading nonfiction books;

(2) Teachers cited improvement in students' level of engagement, ability to work independently, do research, and work collaboratively;

(3) Teachers also talked about gains in content-knowledge specific to the unit of study; and

(4) Finally, teachers spoke of gains in language arts, including increased vocabulary, questioning, writing ability, and increases in reading level.

For *WiggleWorks*, teachers cited improvements in computer skills, writing, reading, and enjoyment of reading. Teachers' descriptions of student outcomes for *KidPix* focused on writing skills, unit content knowledge, and technical skills (like typing, downloading, changing backgrounds, and using textboxes). For *Read, Write, & Type*, teachers reported improvements in students' computer skills, decoding skills, and use of reading strategies. Finally, for *GraphClub*, teachers who reported student outcomes noted students' improvement in making and reading graphs as well as better understanding of the usefulness of graphs for presenting information.

Summary of Sustainability Issues

The main factors in sustaining the integration of inquiry units into the curriculum revolved around the issues of money for needed resources, time for unit development, and opportunities for networking with other teachers. An important element emerged related to these needs: the importance of support and "buy-in" by administrators.

Summary of Technology Ratings

Over 70% teachers integrated Wiggleworks into their curriculum in some way and just under half (43.5%) reported using Wiggleworks at least 1-2 times per week. Teachers' comments

indicated that the software was used throughout the year—even outside the context of the unit developed for the project.

Teachers described integration of Wiggleworks primarily into reading or language centers in their classrooms. Almost all teachers recommended purchasing WiggleWorks again, though comments suggest that this program may be more suitable for kindergarten through second grade.

The use of KidPix was much less consistent than the use of WiggleWorks. About 80% of teachers reported integrating KidPix into their curriculum but the level of use was split in three categories: low usage (defined as only a few times), moderate usage (1-2 times per week), and high usage (3-5 times per week; see Figure 2a). Many teachers described using KidPix to create final products for their units. It should be noted that many teachers also indicated they were unable to use KidPix effectively because of technical problems. Again, most teachers recommended purchasing KidPix. Comments again suggest that there are important system requirement issues and training needs before this software is useful to teachers.

Half of the teachers using Read, Write, and Type indicated they used the program about one to two times a week. Teachers described their integration of Read, Write, and Type into their curriculum primarily as independent work for students. Those teachers who did integrate it more fully into their activities were positive about the phonics and typing aspects. Most teachers (95%; n=20) who responded to the question about purchasing Read, Write, and Type again were in favor of the product.

Most teachers used GraphClub infrequently. Teachers integrated GraphClub in a variety of ways both within and beyond their inquiry units. Students graphed the weather, animals, birthdays as well as used the program during free time. While descriptions indicated teachers

enjoyed using GraphClub, other comments suggest that teachers were more willing to "give it up" compared to the other technologies.

Limitation of Elementary School #1 Analysis There is preliminary evidence that K-3 kindergarten and first graders achieved higher reading scores on the ISEL (Illinois Snapshots of Early Literacy) test compared with students who did not participate in the program.

A Chi Square Test of Independence was conducted to determine if the number of students achieving scores below 130 (the school's cut-off for reading services) and above 130 was different for students in the K-3 program and comparison classes in the same school.

This analysis does not control for differences between students before the school year began. Because students were not randomly assigned to classrooms, it is unknown whether the non-K-3 students were significantly lower readers before the comparison.

Limitation of Analysis from Elementary Schools 2 and 3:

These elementary schools provided data from two test administrations: the Illinois Snapshots of Early Literacy (ISEL) and the Developmental Reading Assessment (DRA). Analyses of these data included tests of gains from pretest to posttest on four ISEL subscales and gains in reading level from pretest to posttest on the DRA for kindergarten and first grade students. All analyses were conducted on K-3 reading students only; there were no comparison student data.

This analysis does not control for natural maturation and reading development that occurs for the student population as a whole. It is unknown whether these student gains were greater than could be achieved by alternative curriculum.

Limitation for Analyses of Elementary Schools #2 and #3:

The non-parametric Wilcoxon signed-rank test was employed to test for differences between the pre- and post-DRA reading levels. The Wilcoxon signed-rank test considers information about both the sign of the differences between the pre- and posttest (i.e., whether the pretest is greater than or less than the posttest) and the magnitude of the differences between pairs (i.e., ranking the differences between all the pairs).

This analysis does not control for natural maturation and reading development that occurs for the student population as a whole. It is unknown whether these student gains were greater than could be achieved by alternative curriculum.

Limitation of Analysis for Elementary School #4:

A power analysis taking into account the differences in variability between the two groups (error variance) and the sample size needed to detect significant differences between the groups was not conducted prior to the analysis. Future analyses should consider power levels in determining appropriate sample sizes and setting minimally important effect sizes to maximize power and efficiency of the analyses.

Area IV

Summary of Recommendations

For a more detailed, accurate understanding of the scope of changes in classroom practices, teacher self-reports should be supplemented by timely journaling, observation, and archival data (e.g., analysis of units developed and implemented).

More systematic measures of affective constructs, student reading achievement and comprehension, and analysis of student work products will greatly expand on the observed student outcomes reported by teachers.

There are several design issues that have limited the evaluation of the impact of inquiry units on students' reading, including sample issues, consistency of intervention, and measurement issues. In terms of implementation, improved book selection and communication about the project to the participants should be considered. Finally, a more complete evaluation design addressing the measurement and sampling issues is needed to show a causal connection between the inquiry units and gains in students' reading. Evaluation planning in the very early fall is crucial to addressing most of the recommendations. Generally speaking, a more comprehensive approach to evaluating the causal link between inquiry and reading should be applied, moving beyond inferences based on indirect teacher reports.

Teacher Reports of Implementation

For a more detailed, accurate understanding of the scope of changes in classroom practices, teacher self-reports should be supplemented by timely journaling, observation, and archival data (e.g., analysis of units developed and implemented).

Teacher Reports of Student Outcomes

More systematic measures of affective constructs, student reading achievement and comprehension, and analysis of student work products should be planned with appropriate sampling across participants.

Tests of Statistical Differences between Groups

The statistical analyses for the summative evaluation had serious limitations for making clear conclusions about the impact of K-3 inquiry units. Maturation, testing, and differences in groups before the projects are all serious internal validity threats. These threats are addressed through a pretest/posttest, control group design. Pre-planned sampling of schools along with the

selection of a published, standardized measure are the primary recommendations for establishing a more powerful analysis of the research questions related to reading achievement.

Sample Issues

Though random assignment to groups is not a practical recommendation for the project, there are other ways to obtain an appropriate control group for reading achievement. For future comparisons, the groups should be matched (stratified sampling) on one or more school level (e.g., average SES, class size, Teacher education) variables and student level variables (e.g., age, gender, race, several variables, reading level) should be collected and entered into the analysis as covariates.

Consistency of Intervention

Though the teachers completed Unit Implementation Logs, a more detailed rating of implementation should be collected. More complete journals of student activities and time spent on units in addition to precise dates of implementation would improve this information. In addition, teachers should write reflections on the units soon after the implementation as well as submit the units and an appropriate, not selective, sample of student projects for analysis. Comparison classrooms should also submit units for analysis to ensure that actual classroom practices are distinct from the inquiry classrooms.

Measurement Issues

Finally, the project continues to struggle with appropriate nonfiction reading outcomes. To avoid the technical problems encountered this year, it is recommended that a published, validated measure for reading be selected for future work. Regardless of the outcome measure selected, actual administration of the instrument should be standardized and limited to a few well-trained testers, rather than individual teachers, whose reliability can be established.

Technology Issues

Teachers struggled with software that was not installed correctly or in a timely manner. Alternatives to relying on existing systems for support need to be investigated and implemented to ensure consistent technical experiences across the classrooms. Teacher technical leaders as well as junior high and high school student computer clubs are possible alternatives.

Training Issues

Teachers generally praised the training and the staff involved in training and support. Participants should be better informed in terms of timelines and required materials for workshops so that work does not have to be duplicated or lost.

General Evaluation Framework Recommendations

A more comprehensive approach to evaluating the causal link between inquiry and reading should be considered for future work. Because of the varying levels of implementation, a broad evaluation in conjunction with a case study approach is appropriate.

Appropriate sample selection

The best sample is a random assignment of schools or classrooms to either the intervention or the comparison condition. Because this project draws on a convenient, volunteer sample for the intervention group, the comparison group should be matched on several variables (i.e., student demographics, school factors, teacher-student ratio, teacher education, regional SES, non-inquiry curriculum).

In selecting an appropriate school for the case study, investigators should consider the most pure implementation of the K-3 intervention. The ideal school will have limited extraneous variables that confuse the impact of the K-3 technology project.

References

Alford, E. (2000). *Curriculum by Design*. Unpublished Training Manual.

Cambourne, B. (2001) Why do some students fail to learn to read? Ockham's razor and the conditions of learning. The Reading Teacher, 54 (8), 784-6.

Drayton, B. & Falk, J. (2002) Tell-tale signs of the inquiry-oriented classroom. NASSP Bulletin, 855 (623), 24-34.

Duke, N. & Kays, J. (1998). "Can I Say 'Once Upon a Time'?": Kindergarten Children Developing Knowledge of Information Book Language.

Duke, N. (2000) 3.6 minutes per day: The scarcity of informational texts in first grade. Reading Research Quarterly, 35, 202-224.

DuVall, R. (2001). Inquiry in science: From curiosity to Understanding. Primary Voices K-6, 10 (1), 3-9.

Palincsar, A. S. & Magnusson, S. J. & Cutter, J. (2002) Supporting guided-inquiry instruction. Teaching Exceptional Children, 34 (3), 88-91.

Pappas, C. (1991). Young children's strategies in learning the "book language" of information books. Discourse Processes; 14(2), 203-25.

Short, K. G., & Harste, J. C., & Burke, C. (1996). Creating classrooms for author and inquirers, 2nd edition. Portsmouth, NH: Heinemann.

Sullivan, J. (1999) Implementing a cooperative learning model: Linking literature with social studies. Illinois Reading Council Journal, 27 (4), 90-95.

Worthy, J. (2000). Conducting research on topics of student interest. The Reading Teacher, 54 (3), 298-99.

Yopp, R. H. & Yopp, H. K. (2000). Sharing informational text with young children. The Reading Teacher, 53 (5), 410-23.

Appendix A

Table 1
Sample Sizes by Data Source For Area V

Data Source	Sample Size
Unit Implementation Log	$n_{teachers}$ =85
Training Evaluation	$n_{teachers}$ =91
Technology Evaluation	$n_{teachers}$ =94
Focus Groups	$n_{teachers}$ =38
School #1 ISEL testing	$n_{students}$ =136
School #2 and #3 ISEL and DRA testing	$n_{students}$ =300
School #4 ITBS testing	$n_{students}$ =158

Appendix B

Area IV Teacher Survey

Area IV Learning Technology Center
K-2 Reading Survey

Name _____ Grade _____

School District _____

---

16. To what degree do students work with you to set learning goals and assessment standards in this unit?

* Completely student-centered
* Mostly student-centered
* Mostly teacher-directed

Technology use:
* Has increased this practice
* Has had no influence
* Is not used at this time

---

17. How often do students work in collaborative groups?

* All or most work is collaborative
* Some work is collaborative
* Most work is individual

Technology use:
* Has increased this practice
* Has had no influence
* Is not used at this time

---

18. To what degree are the tasks in students' collaborative work predefined by you?

* All or most tasks are predefined by the teacher
* Some tasks defined by teacher, some by students
* Most tasks planned & organized by students

Technology use:
* Has increased this practice
* Has had no influence
* Is not used at this time

---

19. To what extent are student tasks directly related to the "real world"?

* All or most tasks involve "real world" scenarios.
* Some tasks are "real world," some are pertinent only to class work or assignments.
* All or most tasks area pertinent only to class work or assignments.

Technology use:
* Has increased this practice
* Has had no influence
* Is not used at this time

---

20. To what degree do tasks require students to use higher order thinking?

* All or most tasks are rooted
* Some tasks require higher
* All or most tasks focus

in higher order thinking.	order thinking and some focus on mastery of specific facts and skills.	on mastery of specific facts and skills.
Technology use: * Has increased this practice	* Has had no influence	* Is not used at this time

21. How often do student assessments require demonstration of knowledge and skills which you evaluate on multiple dimensions?

* Most student assessments involve demonstration of knowledge for self-evaluation, peer evaluation, and teacher evaluations.	* Some student assessments involve demonstration of knowledge and these assessments are evaluated mostly by the teacher.	* Most student assessments are primarily paper and pencil tests with short answer essay for recall and discussion of facts.
Technology use: * Has increased this practice	* Has had no influence	* Is not used at this time

22. To what extent do students participate in the planning and design of problems and assignments?

* Most assignments are defined in collaboration with students based on their interest.	* Some assignments are defined by students, others are selected from assignments I have defined.	* I define most of the assignments and students choose based on their interests.
Technology use: * Has increased this practice	* Has had no influence	* Is not used at this time

23. How do students learn different thinking processes and strategies?

* Most of the time, I model thinking processes and strategizing help as needed on and individual basis.	*Some strategies are learned through whole class instruction, some are modeled by me as needed on an Individual basis.	* Most strategies and thinking processes are learned through whole-class instruction.
Technology use: * Has increased this practice	* Has had no influence	* Is not used at this time

24. How is exploration used in this unit?

* Most student activity involves exploration of issues linked to the curriculum with students posing questions and initiating projects with little prior knowledge.	* There is some time for students to explore new areas of interest and make discoveries and some time for structured activities.	* Most student explorations involve opportunities to make discoveries about topics of interest that don't necessarily link back to the curriculum.

Technology use:

* Has increased this practice	* Has had no influence	* Is not used at this time

Appendix C

Area IV Focus Group Protocol

6/4/02

1) Implementation issues

2) Support/training issues

3) Sustainability issues

4) Student outcome evidence

Appendix D

Area V Training Evaluation

Area 5 K-3 Reading Project Training Evaluation

Personal Information

Name:
Grade:
School:
Email:

Please reflect on your experiences in the K-2 Reading training sessions you have recently attended.

Please think about the overall quality of the training as you respond to the following statements.

Use Likert Scale for Items 1-3 (Strongly Agree, Agree, Unsure, Disagree, Strongly Disagree)

1. This training was logically and coherently organized.
2. The teaching strategies used by the instructor were effective and appropriate for the subject matter.
3. The training activities and assignments were valuable.

Use Text Area for Items 4-7

4. What is the single best aspect of this training?
5. What would you like to see changed in this training?
6. Do you have any other comments or suggestions?
7. Was the support adequate for you as a teacher to make this project successful? If no, please be specific about support that was missing.

Thank you for your feedback!

Appendix E

Area V Technology Evaluation

Area 5 K-3 Reading Project Technology Evaluation

Personal Information

Name:
Grade:
School:
Email:

Please think about the specific technologies in your units as you respond to these questions.

Use Text Area for Items 1-17

WiggleWorks

1. How did you use this product with the students?
2. How often?
3. What were some observable, measurable student learning outcomes?
4. Would you recommend the continued purchase of this software for this project?

KidPix

5. How did you use this product with the students?
6. How often?
7. What were some observable, measurable student learning outcomes?
8. Would you recommend the continued purchase of this software for this project?

Read, Write, & Type

9. How did you use this product with the students?
10. How often?
11. What were some observable, measurable student learning outcomes?
12. Would you recommend the continued purchase of this software for this project?

GraphClub

13. How did you use this product with the students?
14. How often?
15. What were some observable, measurable student learning outcomes?
16. Would you recommend the continued purchase of this software for this project?

Additional Software

17. Is there additional application software you feel would have been appropriate for this program?

Thank you for your feedback!

Appendix F

Area V Focus Group Protocol

Area 5
TLCF K-3 Reading Project

Focus Group Protocol

1. What units did you teach?
2. How long have you been involved in the project?
3. What was your experience like implementing your units this year?
4. What were the barriers to effective implementation?
5. What kind of support (e.g., resources, systems or processes) do you think it takes to sustain and grow this way of teaching?
6. What were important sources of support or barriers to effective implementation?
7. What were your experiences with the technology?
8. What were observable student outcomes that you connect to the units?
9. How do you see student changes translating into better test scores?
10. What did you hear from parents about this?

Appendix G

Table 2a
Chi Square Tests of Changes in Practice

Classroom Practice	χ^2	**p level**
Extent to which students' work with the teacher to set learning goals	10.309	0.001
Extent to which tasks in student collaborative groups is defined by teacher	9.537	0.008
Extent to which students' tasks are related to the real world	7.460	0.024
Extent to which tasks require students to use higher order thinking	8.621	.00001
How often student assessments require demonstration of knowledge on multiple dimensions	6.770	0.034
Extent to which students plan problems or assignments	12.893	0.002
How studs learn thinking processes	8.950	0.011

Table 2b
Changes in Classroom Practice – Learning Goals

Extent studs work w/teacher to set learning goals	Fall	Spring
	Frequency	Frequency
Mostly teacher-directed	26	16
Mostly student-centered	4	17
Total	30	33

Table 2c
Changes in Classroom Practice – Defining Tasks

Extent tasks in studs collab groups defined by teacher	Fall	Spring
	Frequency	Frequency
All or most tasks are predefined by the teacher	19	9
Some tasks defined by teacher, some by students	10	23
Most tasks planned and organized by students	1	1
Total	30	33

Table 2d
Changes in Classroom Practice – Real World Tasks

Extent stud tasks related to real world	Fall	Spring
	Frequency	Frequency
All or most tasks pertain only to class work	2	0
Some tasks are real world, some pertain only to class work	19	13
All or most tasks involve real world scenarios	9	20
Total	30	33

Table 2e
Changes in Classroom Practice – Higher Order Thinking

Extent tasks require studs to use higher order thinking	Fall	Spring
	Frequency	Frequency
All or most tasks focus on mastery of facts	2	1
Some tasks require higher order thinking, some skill mastery	27	23
All or most tasks rooted in higher order thinking	1	9
Total	30	33

Table 2f
Changes in Classroom Practice – Assessments

How often stud assessments require demo of know. on multiple dimensions	Fall	Spring
	Frequency	Frequency
Most assess. paper/pencil tests with short essay	6	0
Some assess involve demo of know & eval mostly by teacher	14	17
Most assess. involve demo of know. for self, peer, tcher eval	10	15
Total	30	32

Table 2g
Changes in Classroom Practice – Planning Assignments

Extend stud plan problems/assignments	Fall	Spring
	Frequency	Frequency
Teacher defines most assignments	20	7
Some assign. def. by studs, others selected fr tchr choices	9	18
Most assign. defined in collaboration w/students	1	6
Total	30	31

Table 2h
Changes in Classroom Practice – Thinking Processes

How studs learn thinking processes	Fall	Spring
	Frequency	Frequency
Most strategies learned thru whole class instruction	4	0
Some strategies learned thru whole-class instr, some modeled	19	25
Most strategies modeled by teacher on indiv basis	7	7
Total	30	31

Table 2i
Unchanged Classroom Practices – Collaborative Groups

How often studs work in collab groups	Fall	Spring
	Frequency	Frequency
Most work is individual	2	0
Some work is collaborative	17	20
All or most work is collaborative	11	13
Total	30	33

Table 2j
Unchanged Classroom Practices – Exploration

How exploration is used in unit	Fall	Spring
	Frequency	Frequency
Most stud explorations are not linked to curriculum	1	0
Some time for stud exploration, some structured activities	23	23
Most stud activities involve exploration of ideas	5	9
Total	29	32

Appendix H

Table 3
Influence of Technology on Classroom Practices

	Technology use has increased this practice		**Technology use has had no influence on this practice**		**Technology is not used at this time to support this practice**	
Classroom Practice	**Pretest %**	**Posttest %**	**Pretest %**	**Posttest %**	**Pretest %**	**Posttest %**
Extent to which students' work with the teacher to set learning goals	56.52	43.33	34.78	43.33	8.7	13.33
Extent to which tasks in student collaborative groups is defined by teacher	57.69	65.63	26.92	25	15.38	9.38
How often studs work in collab groups	60	51.61	32	35.48	8	12.90
Extent to which students' tasks are related to the real world	64	71.88	24	21.88	12	6.25
Extent to which tasks require students to use higher order thinking	40*	68.75*	44*	28.13*	16*	3.13*
How often student assessments require demonstration of knowledge on multiple dimensions	41.67	53.33	41.67	26.67	16.67	20
Extent to which students plan problems or assignments	45.83	42.31	41.67	46.15	12.5	11.54
How studs learn thinking processes	62.5	51.61	29.17	38.71	8.33	9.67
How exploration is used in unit	70.83	80	20.83	16.67	8.33	3.33

* $\chi^2 = 6.173$, $p < .046$

Appendix I

Figure 1a.

WiggleWorks

Frequency of Use

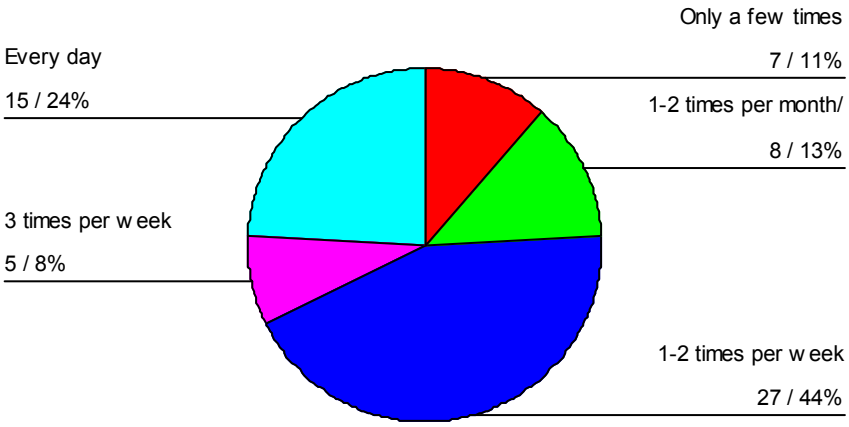
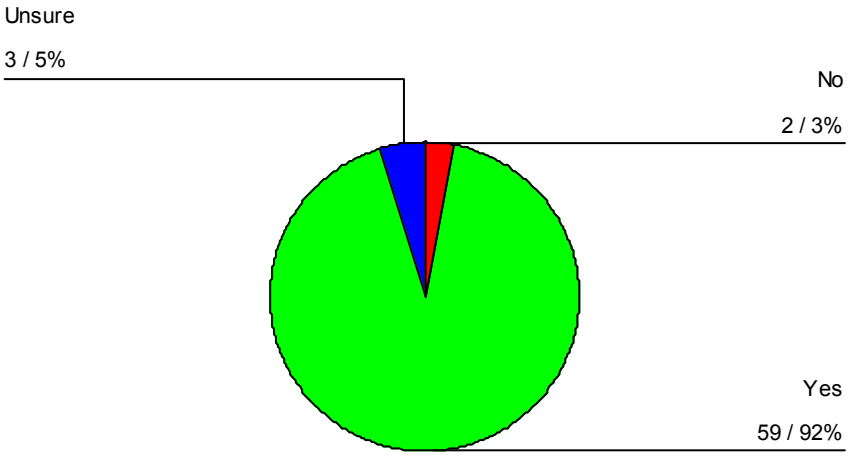


Figure 1b

Recommendation for Purchasing WiggleWorks



Appendix J

Figure 2a.

KidPix

Frequency of Use

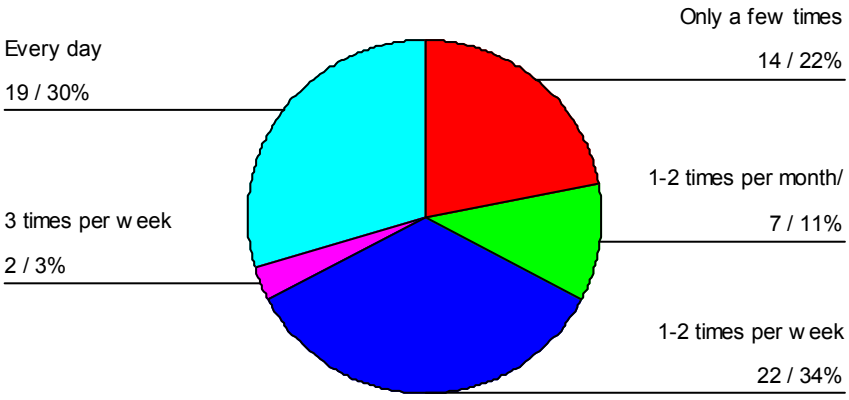
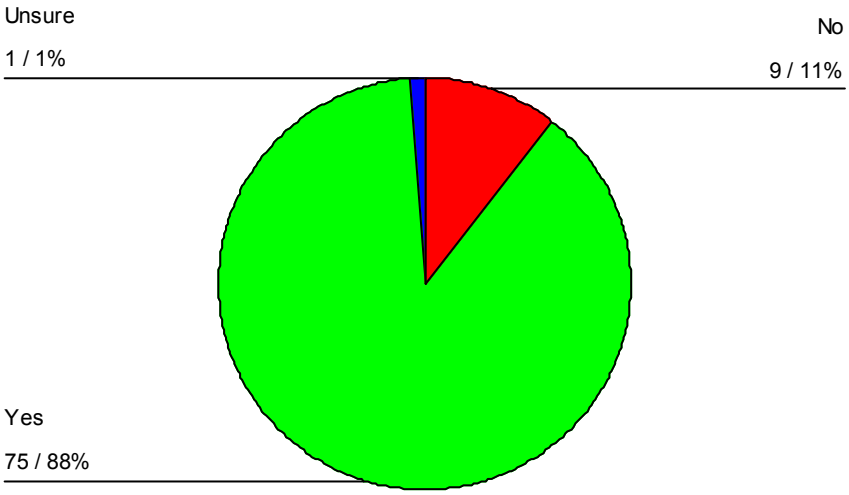


Figure 2b.

Recommendations for Purchasing KidPix



Appendix K

Figure 3a.

Read, Write, and Type

Frequency of Use

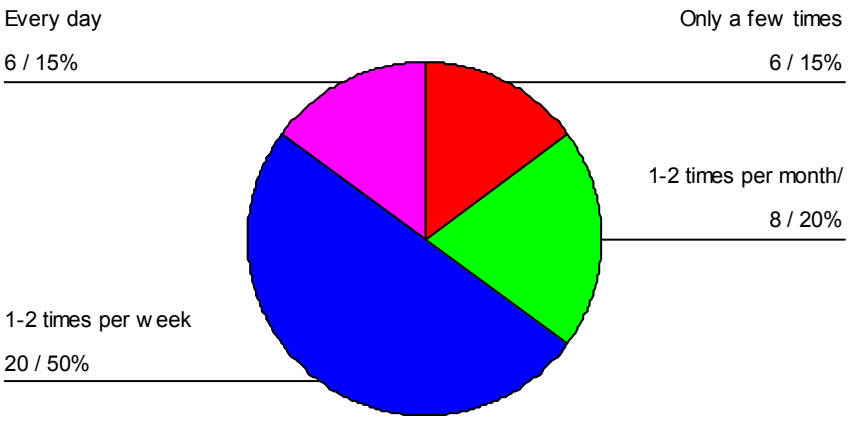
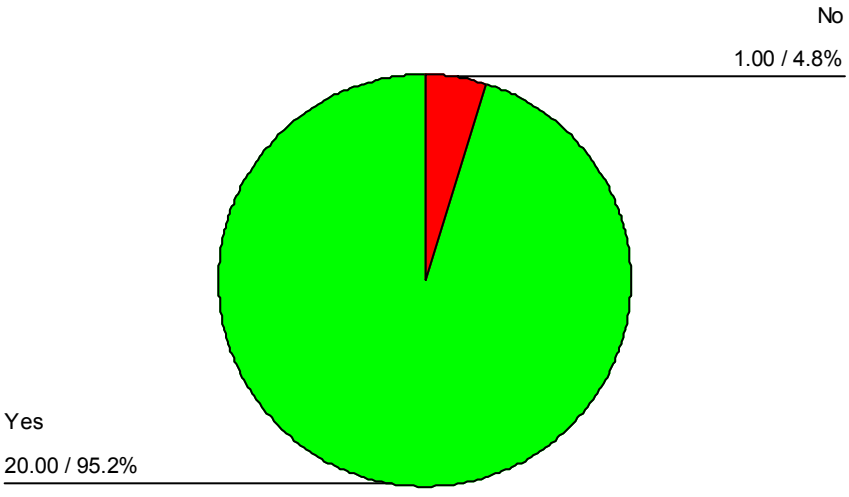


Figure 3b.

Recommendation to Purchase Read, Write, & Type



Appendix L

Figure 4a.

GraphClub

Frequency of Use

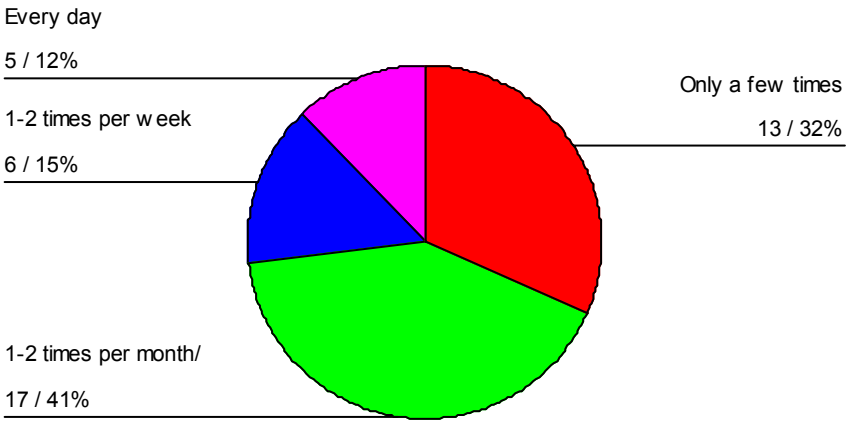
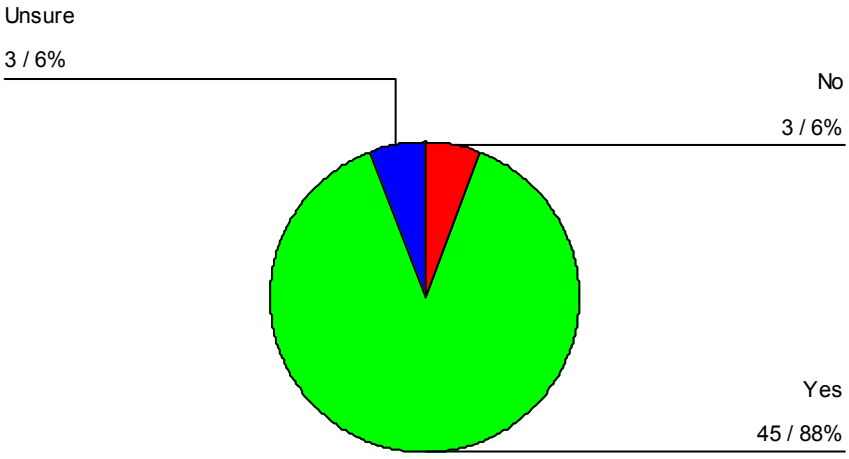


Figure 4b.

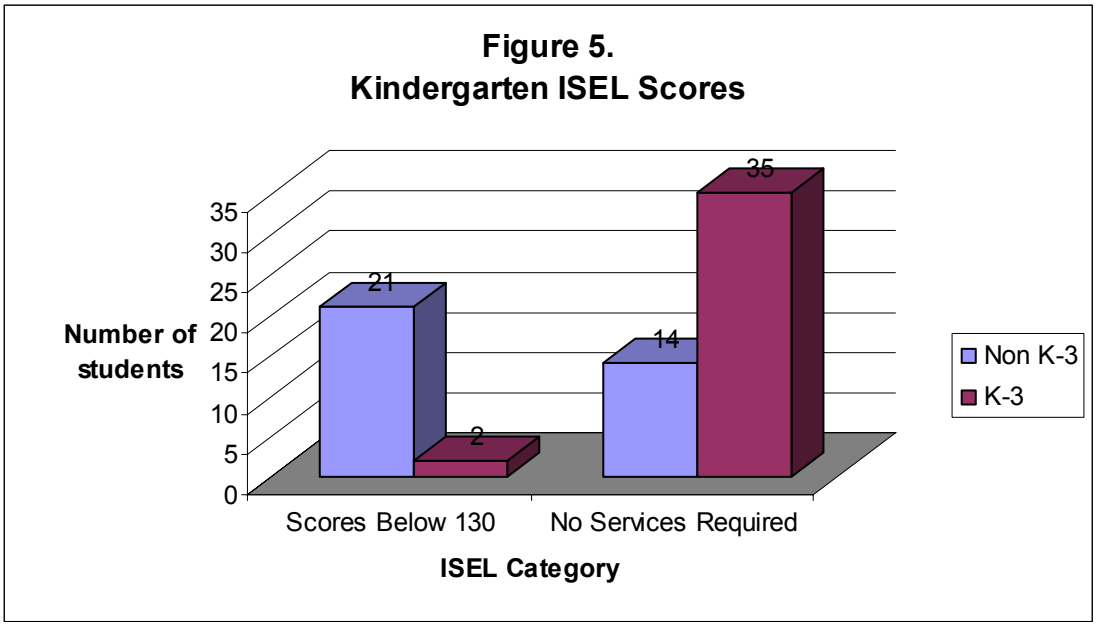
Recommendation to Purchase GraphClub



Appendix M

Table 4.
Kindergarten ISEL Scores

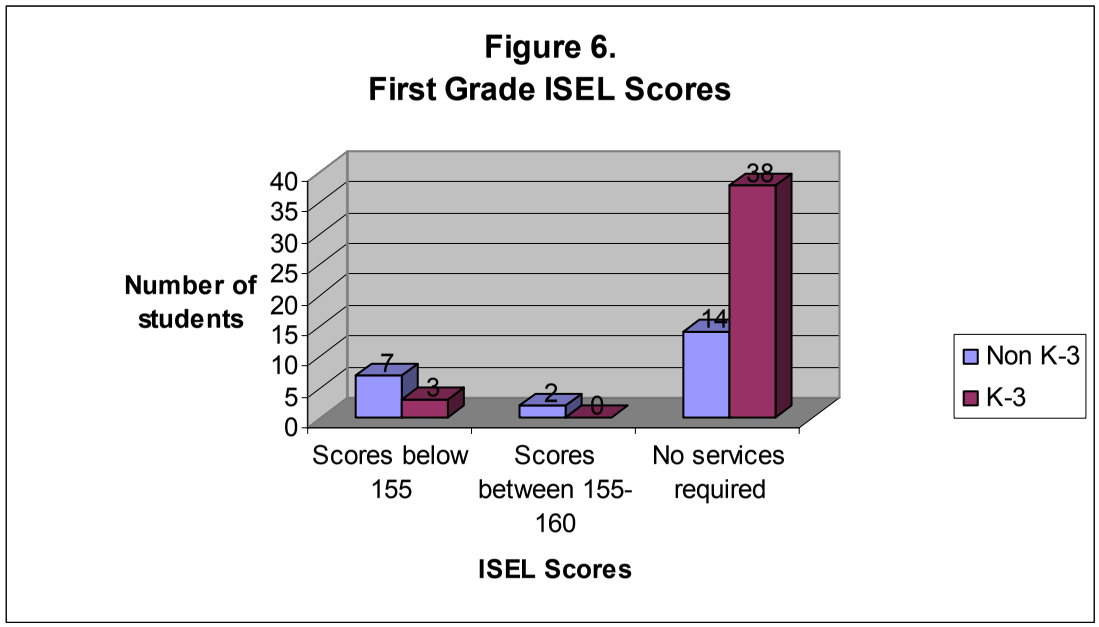
Kindergarten	Non K-3	K-3	Total
Scores Below 130	21 (11)	2 (12)	23
No Services Required	14 (24)	35 (25)	49
	35	37	72



Appendix N

Table 5.
First Grade ISEL Scores

First Grade	Non K-3	K-3	Total
Scores below 155	7 (4)	3 (6)	10
Scores between 155-160	2 (1)	0 (1)	2
No services required	14 (18)	38 (33)	52
	23	41	64



Appendix O

Table 6A.
Pre- and Posttest Mean Differences

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Snapshot 1:Alphabet Recognition (% Correct, out of 54)	Pretest	75.83950617	300	29.15302978	1.683151
	Posttest	97.2037037	300	9.727990774	0.561646
Snapshot 2: Story Listening: Comprehension & Vocabulary (% Correct, out of 21)	Pretest	68.3538316	302	18.92678291	1.089114
	Posttest	86.50268054	302	14.31921888	0.823978
Snapshot 3:Phonemic Awareness: Initial Consonents(% Correct, out of 10)	Pretest	65.34883721	301	27.89793135	1.60801
	Posttest	90.86378738	301	16.20446598	0.93401
Snapshot 4: One-to-One Matching & Word Naming (% Correct, out of 9)	Pretest	67.10473915	279	28.2459846	1.691043
	Posttest	94.86260454	279	14.77177593	0.884363

Table 6B.
Paired Samples T-Test

Paired Samples Test		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				Sig. (2-tailed)	p Adjusted for multiple comparisons
					Lower	Upper	t	N		
Snapshot 1	Pretest-Posttest	-21.36	26.51	1.53	-24.3766	-18.3518	-13.9568	299	1.95618E-34	7.82472E-34
Snapshot 2	Pretest-Posttest	-18.15	15.25	0.88	-19.8761	-16.4216	-20.6776	301	1.00021E-59	4.00083E-59
Snapshot 3	Pretest-Posttest	-25.52	23.54	1.36	-28.1851	-22.8448	-18.8046	300	1.16224E-52	4.64896E-52
Snapshot 4	Pretest-Posttest	-27.758	27.56	1.65	-31.0053	-24.5104	-16.8262	278	2.69036E-44	1.07615E-43

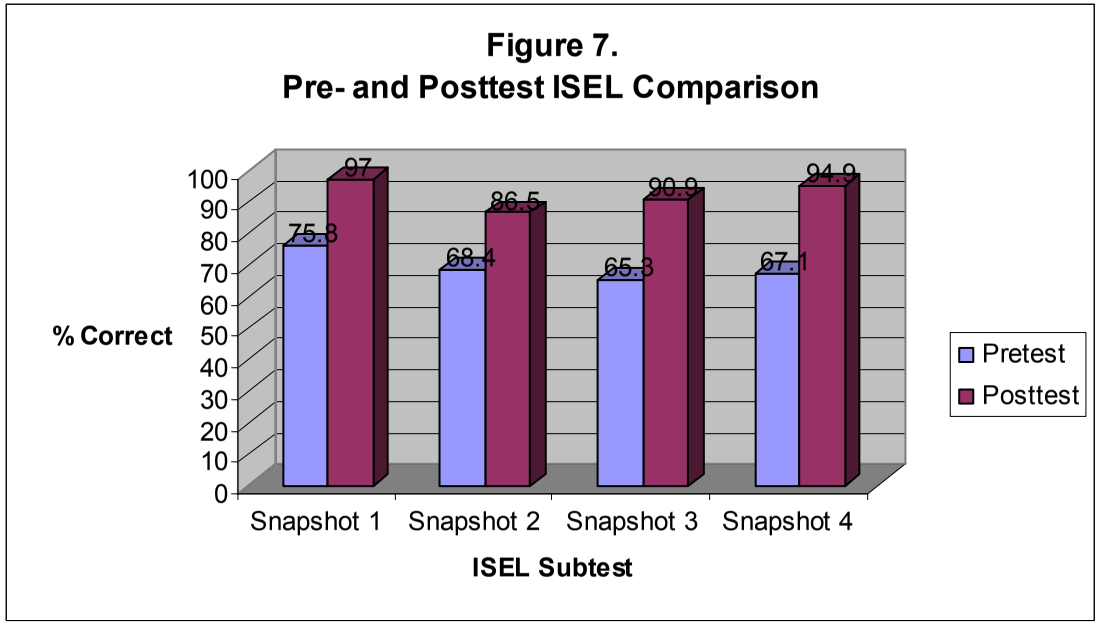


Figure 7.
Pre- and Posttest ISEL Comparison
% Correct
100
90
80
70
60
50
40
30
20
10
0
75.8
97
68.4
86.5
65.3
90.9
67.1
94.9
Snapshot 1
Snapshot 2
Snapshot 3
Snapshot 4
ISEL Subtest
Pretest
Posttest

Appendix P

Table 7a.
Posttest Rank - Pretest Rank

	Ranks	N	Mean Rank	Sum of Ranks
	Negative Ranks	0[a]	0	0
	Positive Ranks	142[b]	71.5	10153
	Ties	6[c]		
	Total	148		
	a=Posttest Rank < Pretest Rank			
	b=Posttest Rank > Pretest Rank			
	c=Pretest Rank = Posttest Rank			

Table 7b.
Test Statistics

	Posttest Rank - Pretest Rank
Z	-10.3457[a]
Asymp. Sig. (2-tailed)	4.38E-25
	a=Based on negative ranks.

Appendix Q

Table 8a.

ANOVA Table for Grade 2 Total Reading NCE Score

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
K-2 & Comparison Groups	1	571.377	571.377	3.383	.0678	3.383	.431
Grade 1 Reading NCE Score	1	24240.290	24240.290	143.522	<.0001	143.522	1.000
K-2 & Comparison Groups * Grade 1 Rea...	1	263.391	263.391	1.559	.2136	1.559	.223
Residual	154	26010.034	168.896				

Table 8b.

Means Table for Grade 2 Total Reading NCE Score
Effect: K-2 & Comparison Groups

	Count	Mean	Std. Dev.	Std. Err.
K-2 Reading Students	81	58.111	15.715	1.746
Comparison Students	77	54.429	20.564	2.343

Table 8c.

Fisher's PLSD for Grade 2 Total Reading NCE Score
Effect: K-2 & Comparison Groups
Significance Level: 5 %

	Mean Diff.	Crit. Diff.	P-Value
K-2 Reading Students, Comparison Stud...	3.683	4.086	.0770