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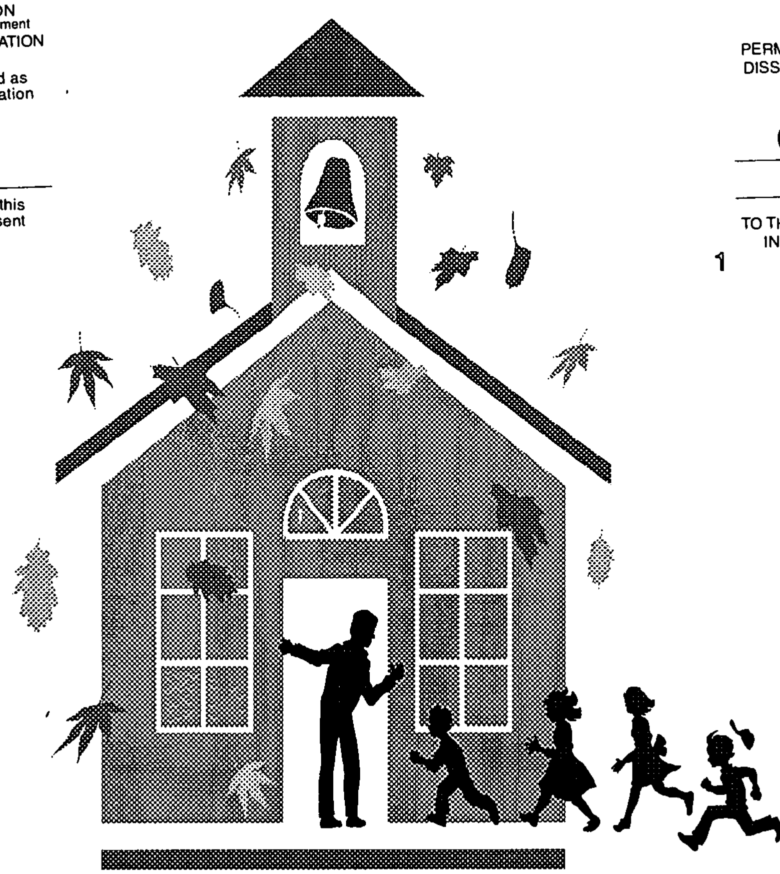
ABSTRACT

The professional development program Using Literacy Integration for Communicating Scientifically (ULINCS) is a joint program of the University of Northern Colorado and Adams Twelve Five Star School District. It had been noted that the increased emphasis on literacy skills was leading educators to place less emphasis on science. The ULINCS project asked elementary school teachers to receive professional development in science content and the implementation of an integrated inquiry-based science unit that also increases literacy achievement. Thirty teachers from grades 3 through 6 participated in the project. Teachers kept journals to record their impressions of how the project benefited teaching and learning. Quantitative assessments evaluated student growth in science and literacy. These assessments included the school district's usual standardized tests. Results suggest that when two or more ULINCS teachers are at a grade level, achievement across the grade level may be improved. Results strongly support the linkage between achievement in science and achievement in literacy when teachers are provided the time, appropriate instruction, and resources to learn the science content and the pedagogical skills necessary to design and implement an integrated, inquiry-based science unit. Findings suggest that de-emphasizing or eliminating the teaching of science to provide more time for literacy blocks may not be the "best practice." (Contains 2 figures, 7 graphs, and 15 references.) (SLD)

Using Literacy Integration for Communicating Scientifically: Research Results on Teacher Efficacy and Student Achievement



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ULINCS
Using Literacy Integration to Communicate Scientifically

Introduction

Experienced elementary teachers may have already reached a personal level of self-efficacy; that is, they have adopted attitudes that allow them to work at a comfortable pace, when dealing with district and statewide change without too much internal turmoil. However, according to Costas and Garmston, "There is a direct link between the types and qualities of teacher thinking and student outcomes. A focus on these 'invisible' skills of teachers. . .help generate new possibilities, increase instructional flexibility and focus on outcomes, not problems" (1994, p. 112). When given a sustained professional development opportunity that challenges their content knowledge and their pedagogical philosophy, teachers may develop an increased capacity that can lead to a higher level of professional efficacy.

A broader more comprehensive view of teaching harkens back to the ancient teachings of Pythagoras, who viewed content areas as unified. In practice, this translated into the one-teacher classroom where a "theme unit" was often presented. Teachers diligently collected every curricular material possible on favored subjects such as butterflies or apples. They felt that by using a designated theme across different subject areas such as math, reading, and science, they were integrating the subject matter. This pedagogy held sway for some time.

The current trend in education has been to address national, state and district-wide standards for Literacy, Mathematics, and Science with the ultimate goal to support student achievement. Although the standards movement gave teachers a structure and framework to teach the various disciplines, it has also separated, at least in the minds of some teachers, the knowledge areas that then become isolated instructional events. For teachers, capacity can be increased when they build discrete knowledge about each standard. But is that enough?

We will present data that demonstrates that a cognitive shift needs to take place. When teachers look at the standards, even within one discipline, let alone across disciplines, they recognize that they cannot teach them all as separate units. They begin to see that there are common grounds within the standards and that there are similarities in the objectives and goals across the standards. Today teachers are challenged to produce a different type of integrated unit. They must switch to a new conceptual basis by beginning a unit, not with a topic, but with specific content standards, and by ending with a synthesis of these standards.

If the purpose of professional development is to build teacher capacity or, in the terms of Vygotsky (1962), to enlarge their zone of proximal development, then teachers need to be able to increase their body of professional knowledge. This will allow them to be more effective in terms of their pedagogical skills and instructional strategies, to build their ability to communicate with colleagues, and to allow personal reflection on professional growth so that they might better serve as mentors and models to other educators.

Professional development extends teachers' visions of who they are and what they can do as professionals; it broadens their horizons as educators and empowers them as agents of change in the broader scope of education. Instead of feeling isolated, teachers who volunteer for professional development programs such as Using Literacy INtegration for Communicating Scientifically (ULINCS) become members of a larger sustained community of educators (Figure 1).

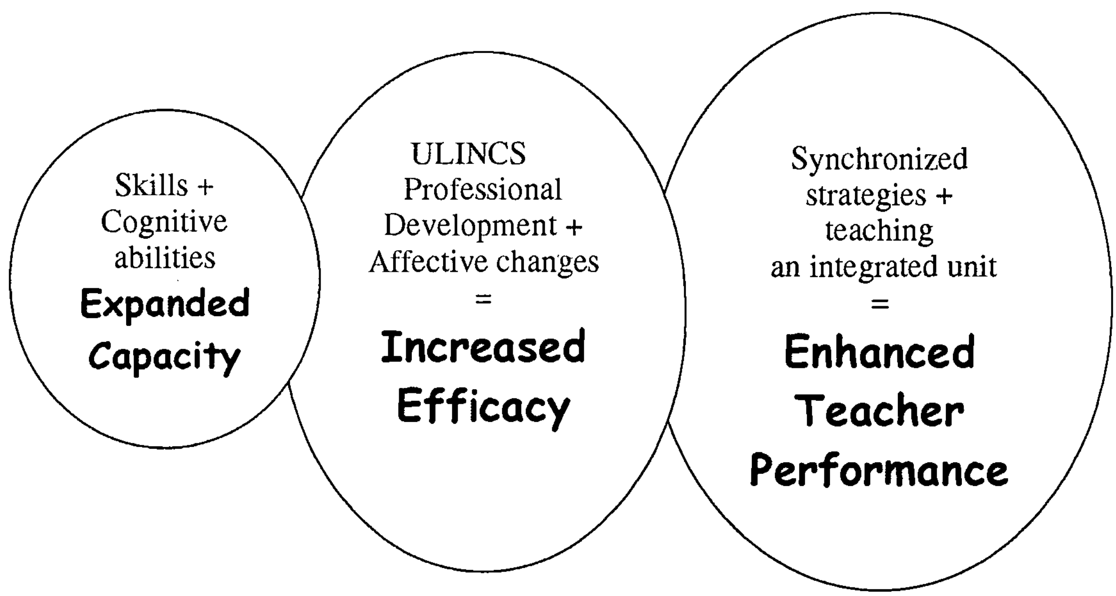


Figure 1. Teachers increase their capacity for learning and teaching through the ULINCS professional development program.

<u>About ULINCS</u>

- Joint project between the University of Northern Colorado and Adams Twelve Five Star Schools
- Funded by Higher Education Eisenhower Partnership Grant

<u>Why ULINCS?</u> In 1998, both school district and university science educators began reporting that more and more elementary schools were de-emphasizing or dropping the teaching of science to provide more time for daily literacy blocks. It was and is the belief of many educators that spending more time on instruction in literacy is the answer to increasing reading and writing scores on the statewide Colorado Student Assessment Program (CSAP). Unfortunately, this practice sacrifices the teaching of science (and other areas) – areas which are inherently motivating, content-rich, and filled with opportunities for meaningful and authentic literacy instruction.

In December of 1999, Higher Education Eisenhower Funds became available to use for University-School Partnerships that focused on integrating science and literacy. The University of Northern Colorado and Adams Twelve formed a partnership to implement a model for the professional development of teachers that had the potential to demonstrate the powerful link between the teaching of elementary science and improved achievement in literacy.

For ULINCS, literacy is defined as those skills that relate to reading, writing, speaking, listening, and viewing. Sutton (1992, p 79) pointed out, "The individual learner's idea of what writing is for can be extensively shaped by the attitudes of the teacher, and what the teacher explicitly or implicitly encourages." He emphasized the following factors for writing about science:

- What the teacher does with pupils' writing when it has been completed.
- The amount of time spent beforehand on discussing the purpose of the writing, its possible form and content, expectations in terms of style, and reasons for these.
- The writer's sense of audience while attempting to set down ideas.
- The extent to which the teacher allows and encourages a variety of styles.

All these are deeply affected by the science teacher's belief about what the writing is for.

Sutton (1992, p. 92) also reminded teachers that students need continuous reading in science about an idea, yet current science texts are not written in this format. He wrote, "We also need more narrative that engages the reader, and books on scientific ideas which have an emotional appeal without sacrificing the need for good intellectual content." The FOSS science materials used in the ULINCS program have supplemental "Readers" that helped fulfill this goal. Therefore, for the purposes of ULINCS, improved achievement in reading was the literacy focus because testing data was available to track student achievment.

Mathematics and technology were also areas targeted for integration with science. Data from the fifth grade Colorado Student Acievement Program (CSAP) and Adams Twelve District Level Mathematics Tests were used to assess achievement in mathematics.

The Question: Can elementary classroom teachers teach an integrated, inquiry-based science unit while simultaneously improving achievement in both science and literacy?

The Hypothesis: If an elementary class is engaged in an integrated, inquiry-based science unit, achievement in science will increase and achievement in reading will increase as measured by District Level Tests and CSAP Reading scores. In fifth grade (the only grade with a Mathematics CSAP), mathematics achievement will improve.

The Procedure:

As part of ULINCS, teachers were asked to do the following:

- Participate in a one week workshop in June of 2000 to receive professional development in:
  - science content,
  - science pedagogy best practices,
  - content area reading strategies ,
  - mathematics content,
  - mathematics pedagogy best practices,
  - the integration of technology in instruction, and
  - the design and implementation of a conceptually-based, integrated science and literacy unit.

- Participate in four, one-half day Saturday workshops to continue their professional development in:
  - the areas of the weeklong workshop,
  - implementing units, and
  - reflecting on instruction.

- Experience at least one classroom visit by the district ULINCS Staff that involved one or all of the following:
  - ULINCS teacher and district staff co-teaching,
  - Observation of ULINCS teacher by district staff, and
  - Observing a "model" lesson taught by district staff.

- Participate in a three day, June, 2001, workshop to do the following:
  - Complete ULINCS Unit Folio for teacher evaluation,
  - Present Folio to other ULINCS teachers,
  - Plan for future, and
  - Celebrate successes.

The Observation:

Part A. Teacher Efficacy

The goals of professional development are to allow elementary teachers to develop a profound understanding of the content they must teach and to be more effective in terms of their pedagogical skills and instructional strategies, to build their ability to communicate with colleagues, and to allow personal reflection on professional growth so that they might better serve as mentors and models to others. Professional development extends elementary teachers' visions of whom they are and what they can do; it broadens their horizons as educators and empowers them as agents of change in the broader scope of the educational enterprise. Instead of feeling isolated, teachers who participate in professional development programs, such as Using Literacy INtegration for Communicating Scientifically [ULINCS] project, become members of a larger sustained community of educators.

The goal of the ULINCS project was to make explicit the linkages between science and language arts standards while embedding mathematics connections. National, state and district content standards underpinned this project. The major innovation of this project was to demonstrate how discrete content standards for science, language arts and mathematics could be combined into a comprehensive standard which would serve as the basis for curricular units integrating mathematics and language arts within the context of elementary school science. This two-year professional development project provided a model for integrating content area literacy skills of mathematics, reading, writing, and oral communication with the teaching of science. Mathematics is the communication tool for science. Mathematical processes, such as proportional reasoning, critical thinking and problem solving, are essential to achieve conceptual understanding of scientific ideas.

Thirty teachers from grades 3-6 participated in the project. The ULINCS project began with a week-long workshop during the summer and was followed by four Saturday morning workshops, classroom observations by project staff and e-mail journaling that academic school year. During this time, teachers finished the writing and implementation of their integrated science units. The next summer, they presented their units, shared student work, and discussed their experiences.

At the initial summer session and during the Saturday workshops, participants were given explanations and written examples about combining content standards. Some found these relatively easy to write, while others were bogged down in the wording, thinking it was dense and ponderous even when wording was taken directly from the standards.

Qualitative Data

While planning and writing their integrated science units, the ULINCS teachers volunteered comments from their reflective journals. Qualitative data illustrate how the teachers and students benefited from content integration as an aide to communicating scientific ideas.

The ULINCS teachers reported that they saw:

- hard-working educators attempting to increase their knowledge and skills to teach children.

- excellent presentations and ideas to integrate mathematics, language arts and technology into elementary school science.
- educators actively engaged in learning science.
- a fantastic connection between their school district and the university.
- lots of great ideas being implemented.
- people talking and interacting about subject matter.
- educators developing profound understanding of fundamental mathematics and science concepts.
- elementary school teachers making connections across content areas.
- good teaching practices being modeled.
- many helpful teaching strategies that can actually be used.

The ULINCS teachers reported that they experienced:

- hands-on measurement laboratory centers.
- lots of hands-on science investigations.
- writing in the context of mathematics and science.
- integrating language arts and mathematics into elementary school science.
- new things on the computer they had never done before.
- lots of thinking and planning.

The ULINCS teachers reported that they heard:

- good discussions about many topics.
- new ways to teach and do things.
- strong science and mathematics language use.

Teacher reflections from the initial summer ULINCS workshop show an increased interest in promoting inquiry-driven instruction.

- *I like the concept of inquiry based teaching…but putting it into action is the challenging part.*
- *I learned more about inquiry based teaching and learning. We were given a lot of interesting ways to pose questions.*
- *I have realized that there are two forms of thinking I must follow. Think as the teacher to anticipate questions and ensure they understand the concept. Prior to answering these questions, you should put yourself into their shoes to see if the lesson makes sense or if it has any gaps."*
- *Inquiry: How else could I look at it differently? Promote healthy skepticism.*
- *I will concentrate more on content. I wonder if I didn't go into depth enough with the students. What is too much for them?*

Quantitative Data

Quantitative pedagogical and content assessments were developed by the

ULINCS staff, and were administered at the beginning and end of the initial summer workshop. The assessments were scored by the ULINCS staff, and the data were analyzed by the external evaluator. Six open-ended knowledge/skills questions were administered, in addition to a 10-item Likert scale teacher self-assessment of proficiency in pedagogical knowledge and skills scored using a 0 to 4 rubric. Repeated measures statistical analysis revealed a statistically significant increase of 60.9% from pre- to post-test. The results are summarized here:

time	n	mean	st. dev.	% increase	t	p
pretest	26	11.42	6.15			
posttest	26	18.38	2.08	60.9%	6.03	.0000

It is important to establish the practical significance of statistically significant gains. In the case of the analysis presented above, consider that with 24 possible points on the pedagogy knowledge/skills assessment, a score of "17' or higher would be, traditionally, a "C" grade or better. Using this line of thinking, the distribution of pre- and post-test scores were n=20 and n=11, respectively.

The ULINCS teachers gained knowledge in each of the elementary school science subject areas: the Human Body, measurement, Water, Health and Nutrition, Magnetism, Electricity, and Landforms. Each subject area group contained two to five members, according to the grade-level science standard addressed. Moreover, all ULINCS teachers were given a pre- and post workshop assessment of their knowledge of metric measurement concepts. This test had a possible score of 21 points. The pre-test showed a group mean of 9.68 points with a 2.79 point standard deviation; the post-test group mean was 14.08 points with a 2.10 point standard deviation. The data reflects a 45.4% gain score.

A second-strata goal of the ULINCS project was to significantly improve student achievement in the areas of science, language arts and mathematics as measured by standards-based assessments. District Grade Level Achievement tests showed improvement in mathematics, reading, and science. Colorado Student Achievement Program (CSAP) test scores were raised in mathematics and reading; science is not tested until grade 8. Three of the four schools showed increased achievement in reading. In all ULINCS fifth grade classrooms and schools, the teachers reported emphasizing the improvement of mathematics skills through science because of low CSAP mathematics scores in previous years. Many more mathematics integration pieces were added to the fifth grade science units, Magnetism/electricity and food/nutrition, than in grades three and four. These observations suggest that the teachers understanding of how mathematics is used in the context of science supported increased emphasis on integrating mathematics over literacy.

The project team believes that the ULINCS project accomplished many of the vital signs for effective group professional development. One of the most telling improvements made by the ULINCS teachers was their ability to acknowledge and change their approach to choosing and synchronizing strategies to enhance the integration of science, mathematics and literacy. In their own words they commented about their intentional use of strategies:

"When we choose strategies to teach the science concepts, we need to know our own students' background, abilities, knowledge and behavior."

"Branching out to try new strategies is so important."

"A difficult part to integrating is to figure out ... which skills should be taught prior to which one."

"It was so valuable to do some hard thinking about how it is we go about choosing the strategies when we teach kids to navigate the wonderful world of learning. I often let myself rely on the tried and true techniques I'm comfortable with when I should be stretching beyond."

"I do know that I have a variety of strategies to choose from. I surely need to look and think more clearly about what I want the kids to come away with."

"When we use a particular strategy, explain it to the students and tell them what you are doing and what it is called."

"An eye-opener: using student reading log for speaking and listening at least once a week. I will need to model this with something I am reading."

There was a concern that some teachers worry about the name they call a literacy, science or mathematical strategy. They felt that a different name might confuse the students the next year. One teacher reported "that some students might be irreparably damaged if next year's teacher call strategy "x", strategy "y." However, she countered that the point of teaching a heuristic strategy is to help students make meaning. "The strategy is a tool - not the point of learning.

A strategist is a problem solver who has some systematic way of going about things... the strategy is an artificial scaffold to help access material that would otherwise be inaccessible." It is assumed that at some point the scaffolding can be removed and the brain will process the text efficiently, and thus allow for making meaning. Further educational research is needed on what students are thinking at a metacognitive level when they process and translate a heuristic mathematical or literacy strategy within a science lesson. The processes used by the ULINCS teachers to achieve their goals are visualized in Figure 2.

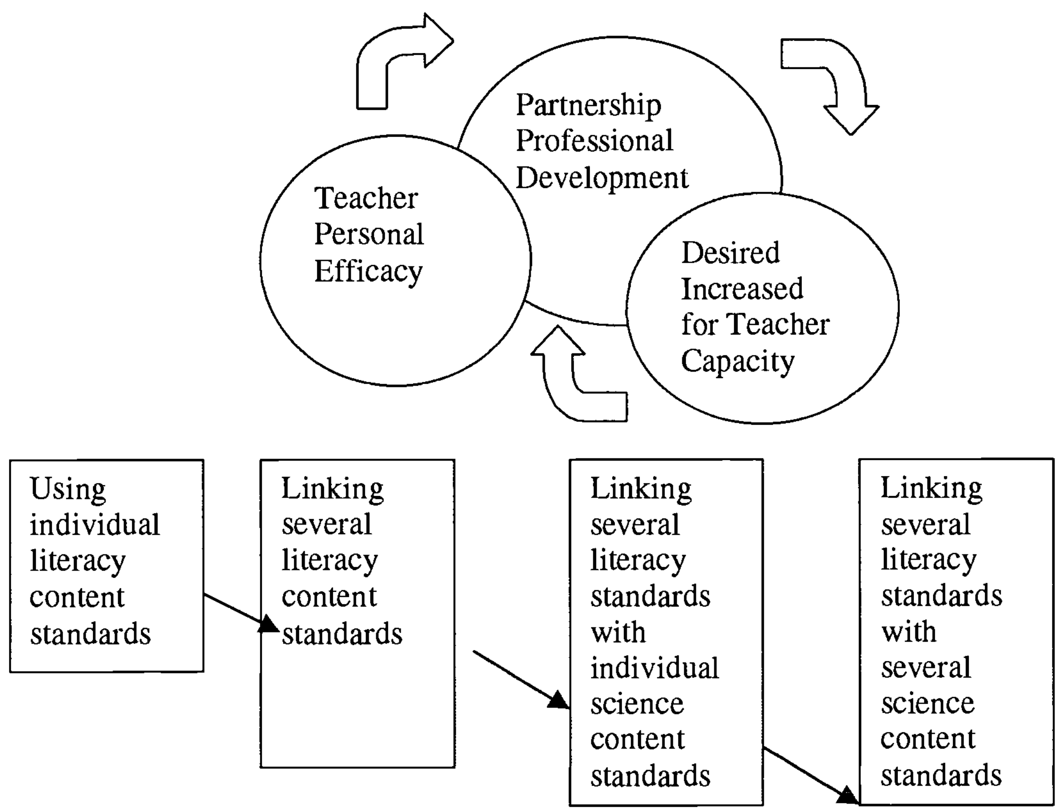


Figure 2. The ULINCS processes for creating an integrated science-literacy units.

Part B. Student Achievement

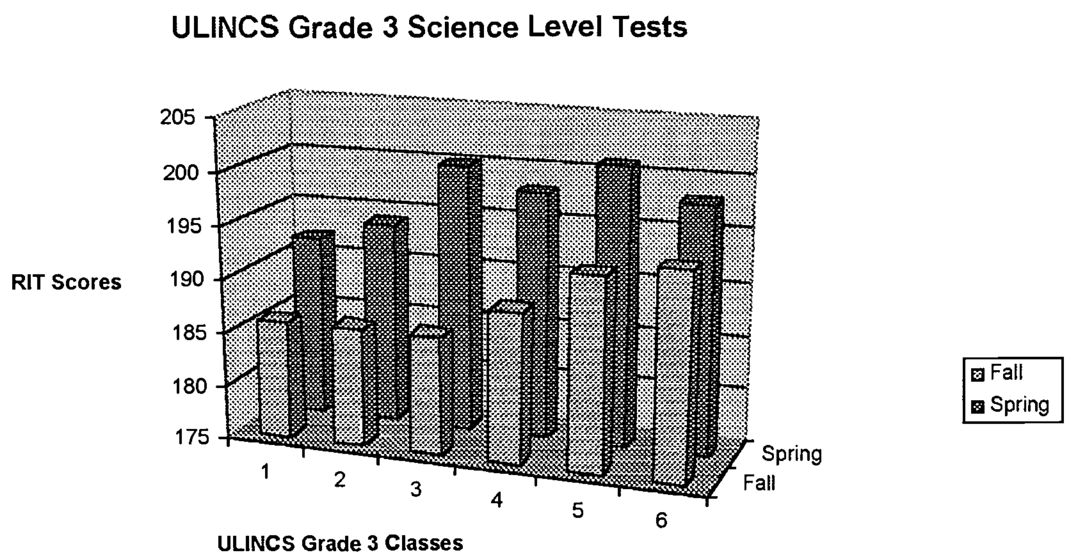
The Teachers/Schools: The self-selected ULINCS teachers represented ten different elementary schools. Data are reported for only seven of the schools because three of the schools had only one teacher at a single grade level. Of the seven ULINCS schools with teacher teams, one was a Title I school, and three had significant numbers of at-risk students with one having close to 50% at-risk. One was a special education center school and two other schools reported more than 10% special education students . Two schools reported 10% or more gifted and talented students with one school reporting 13% g/t. Two schools reported 2% English Language Learners.

How the Data was Reported:

Although all ULINCS teachers gave the Science Concepts and Processes Level Tests both Fall 2000 and Spring 2001, the data could only be used from seventeen teachers due to problems with scoring level tests and re-testing of students. All teachers who had complete data for Fall 2000 and Spring 2001 Science Level Tests have their data reported in the results. Only the ULINCS class data are reported for science since their nonULINCS colleagues were not required to report science achievement data.

Reading and Math data represents the entire grade level; this includes both ULINCS and nonULINCS teachers at that grade level in each school. Only grade levels with two or more ULINCS teachers were reported. Since all schools were required by the state or the district to report scores in reading and math, these data were accessible for this study.

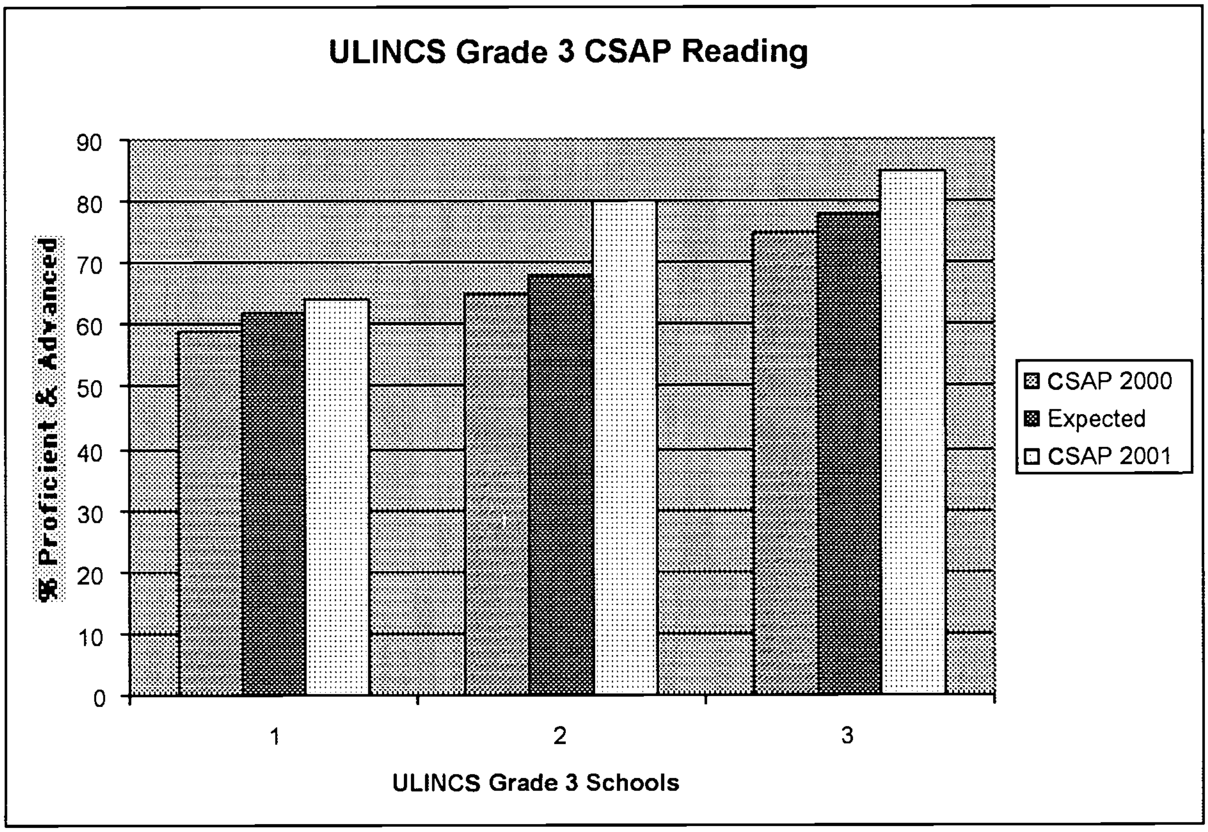
The Results - Grade 3



	1	2	3	4	5	6
Fall	186	186	186	189	193	194
Spring	192	194	200	198	201	198

The graph above shows the results of all of the ULINCS third grade teachers for Fall and Spring scores for their classes on the Science Concepts and Processes Level Tests. This test measures students' abilities to understand key science concepts related to cause-effect, cycle, force, interaction, model, scale, systems, and theories. It also assesses the science thinking processes of classifying, interpreting data, inferring, measuring, observing, questioning, and designing experiments.

On the Science Level Test a gain of 4 RIT units is comparable to one year's growth. All six ULINCS classes demonstrated a year's growth or more. In three classes (2, 4 and 5), two years' growth were recorded. In one class (3), three years' growth was recorded.

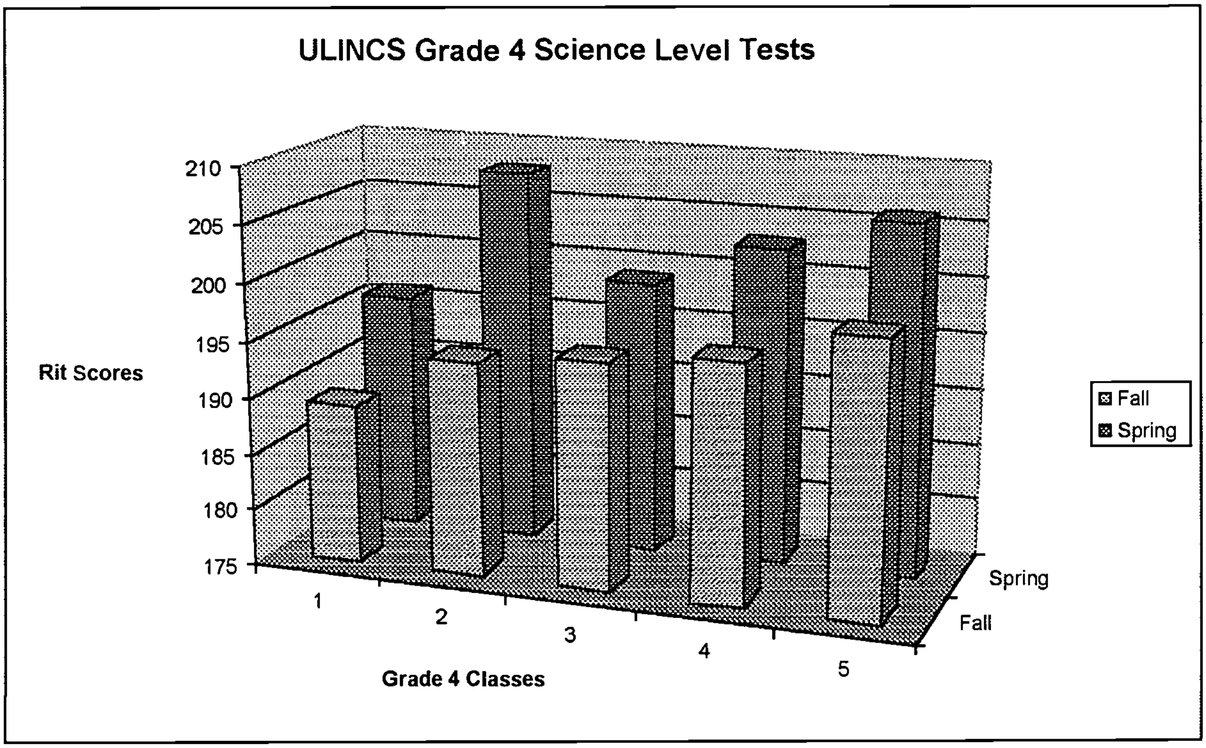


In the graph above, the entire grade level's Spring 2000 CSAP Reading scores (which includes non ULINCS teachers) are compared to their Spring 2001 CSAP Reading scores. The expected score is derived from assuming that if the students remained at the same level in reading, their scores would have improved in relationship to the statewide increase of scores.

The six third grade ULINCS teachers represented teams of two from three elementary schools. **In all three schools, reading achievement increased.** This is significant because not all the students represented by this data were from ULINCS classrooms. We attribute some gain to the fact that ULINCS teachers plan and teach together at their grade levels, and share strategies from the ULINCS professional model. Improvement in scores may also be attributed to the new reading series, Scholastic's Literacy Place Program.

The results suggest that when two or more ULINCS teachers are at a grade level, achievement across the grade level may be improved.

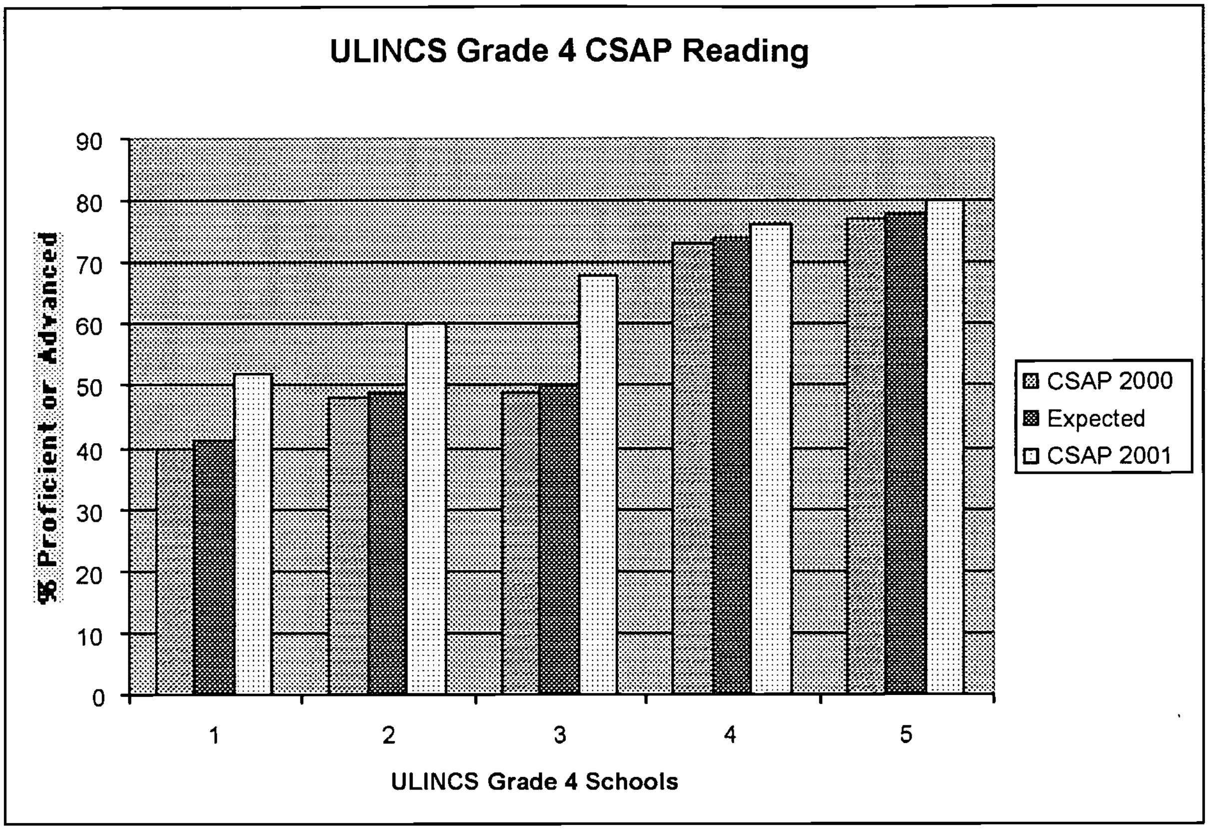
The Results-Grade 4



The graph above shows the results of the fourth grade ULINCS teachers that had both Fall and Spring scores for their classes on the Science Concepts and Processes Level Tests.

On the Science Level Tests a gain of 4 RIT units is comparable to one year's growth. All five classes demonstrated at least a year's growth. In Class 2, three years' growth was reported. Two of the schools were Title I Schools and are represented as "School 1" and "School 2" in the above graph.

The units selected for integrating with literacy were FOSS Landforms, FOSS Water, and the newly developed Colorado Wildlife Unit. The Colorado Wildlife Unit, although not a FOSS Unit, was designed after FOSS and served as the ULINCS standard for how to integrate science and literacy.

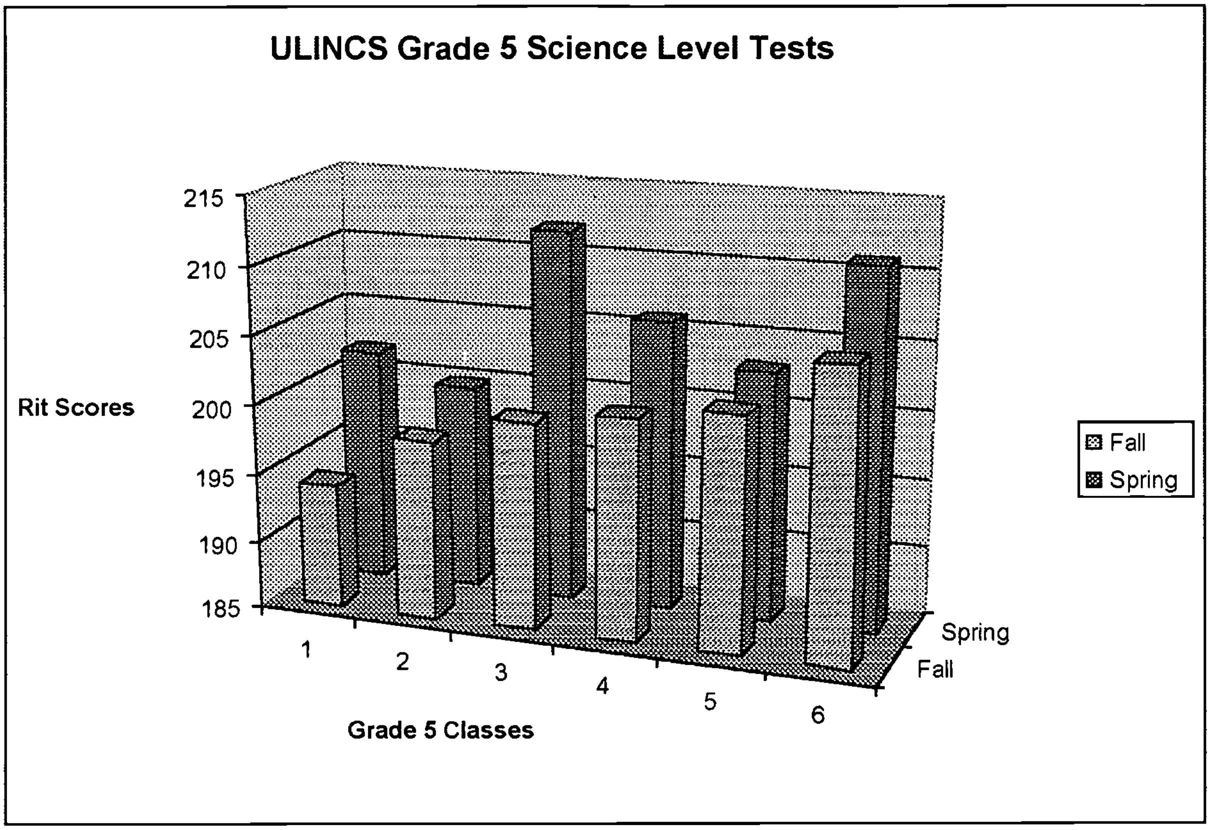


The graph above represents all of the fourth grade ULINCS teachers. Their Spring 2000 CSAP Reading scores are compared to their Spring 2001 CSAP Reading. The expected score is derived from assuming that if the students remained at the same level in reading, their scores would have increased by the increase statewide.

In all five schools, CSAP Reading achievement increased over the entire fourth grade. It should be noted that even the two schools with relatively high reading scores, increased over the expected and that significant gains were made by the lower performing schools

Once again, this data represents both non ULINCS classrooms and ULINCS classrooms. District staff observed that grade level team planning was the standard in these schools. Thus, this suggests that even non ULINCS classes benefited from U- LINCS units.

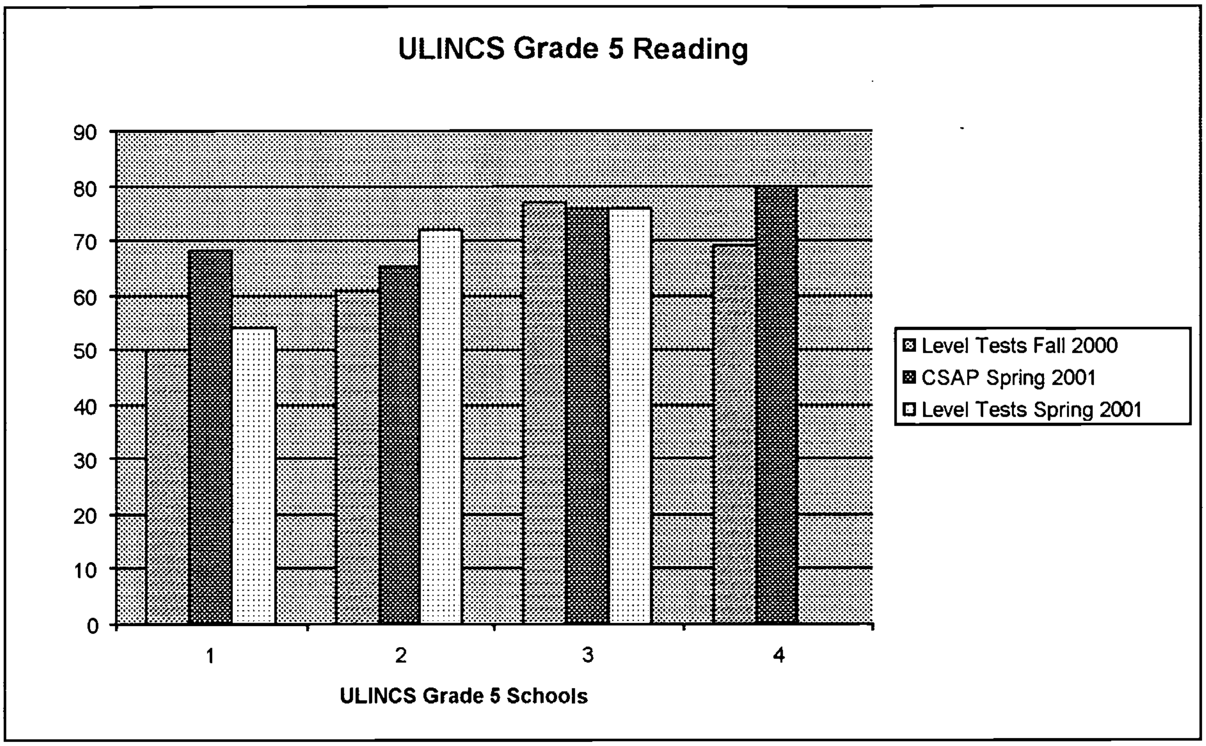
The Results-Grade 5



The graph above shows the results of all of the fifth ULINCS teachers that had Fall and Spring scores for their classes on the Science Concepts and Processes Level Tests.

On the Science Level Tests a gain of 4 RIT units is comparable to one year's growth. Although all classes demonstrated growth, two of the classes (Classes 2 and 5) did not demonstrate a year's growth. In two classes (4 and 6), students grew 5 RIT units for a year's growth, in one class (1) students grew two years, and in a third class (3) students grew three years.

The units selected for integrating with literacy were FOSS Magnetism & Electricity, and FOSS Food and Nutrition.



The six, fifth grade ULINCS teachers represented four different schools. Since a Spring 2000 Reading CSAP was not administered in Colorado, the Fall 2000 and Spring 2001 Reading Level Tests were used to compare growth. The Spring 2001 CSAP is also provided for comparison. School 4 did not elect to do a Spring Reading Level Test.

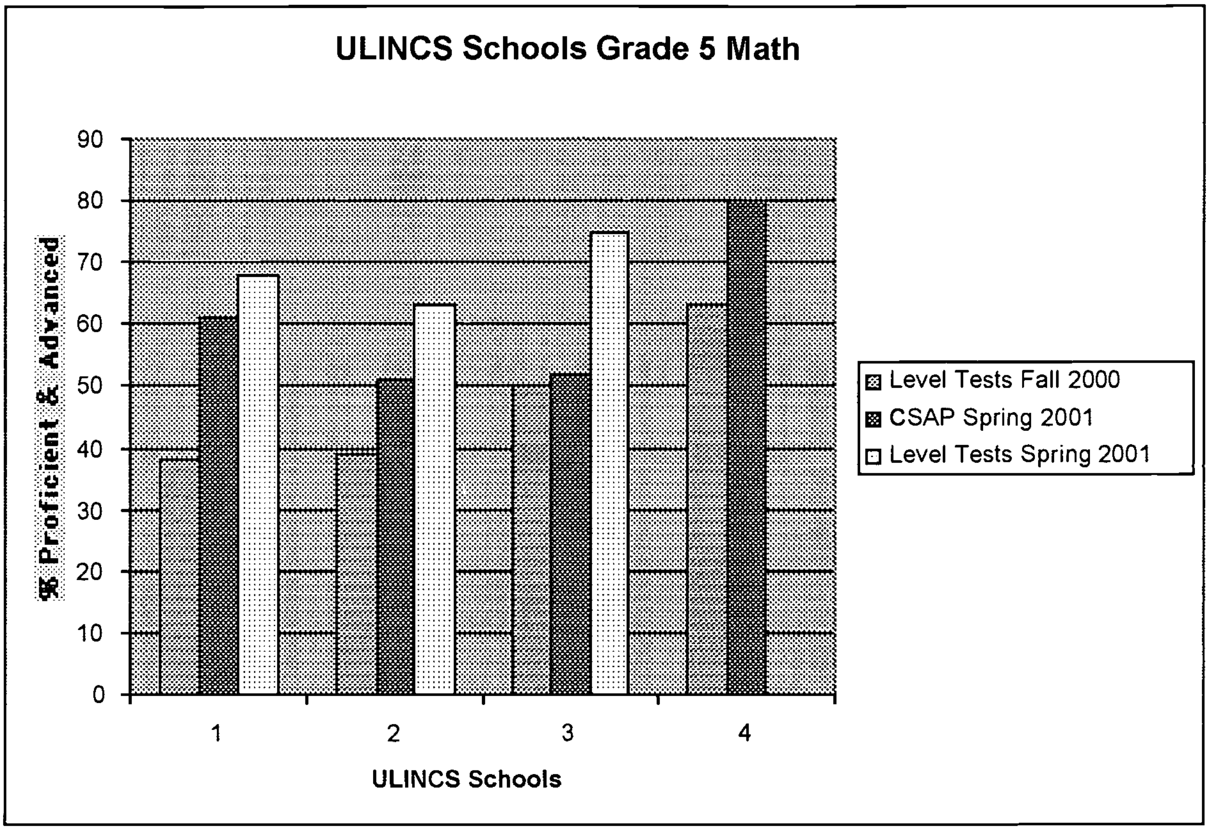
School 1 shows a year's growth in reading if one compares Fall 2000 Reading Level Tests to Spring 2001 Reading CSAP.

School 2 shows a year's growth in reading if one compares Fall 2000 Reading level Tests to Spring 2001 Reading Level Tests.

School 3 shows no growth in reading achievement using Reading Level Tests Comparisons or CSAP comparisons.

School 4 shows a year's growth in reading if one compares Fall 2000 Reading Level Tests to Spring 2001 Reading CSAP.

Thus, three of the four schools showed increased achievement in reading.



The Math CSAP was only given in fifth grade in Spring 2001 and was not given in grades three and four. Since the Math CSAP was not administered in Spring of 2000, the Fall and Spring Math Level Tests were used to chart mathematics achievement.

In all four schools, mathematics achievement exceeded a year's growth when using either the Fall to Spring Mathematics Level Tests comparisons or the Fall Mathematics Level Tests to Spring Math CSAP.

FOSS Science has embedded mathematics problems and emphasizes extensive use of students working with numeracy skills, geometry concepts, probability, collecting data, making graphs, and interpreting data from charts and graphs.

In all ULINCS fifth grade classrooms and schools, teachers reported emphasizing the improvement of mathematics skills through science because of their low Fall 1999 Math CSAP scores. Many more mathematics integration pieces were added to the fifth grade science units than in grades three and four. These observations suggest that the lower science achievement in two classes (both teachers reported focusing on mathematics) and the lack of growth in reading in a school that had higher than average reading achievement may reflect the increased emphasis in integrating mathematics over literacy.

The Conclusion from Student Achievement Data:

The results of this study strongly support the linkage between achievement in science and achievement in literacy when teachers are provided the time, appropriate instruction, and resources to learn the science content and pedagogical skills necessary to design and implement an integrated, inquiry-based science unit.

Given the substantial evidence in this study, we advocate that de-emphasizing or eliminating the teaching of science to provide more time for literacy blocks may not be "the best practice." Science, an inherently motivating and stimulating subject for elementary students, can be positively integrated with literacy. In fact, the data suggests that integrating literacy with content increases achievement in science, reading and math as evidence by results on both district and state-wide assessments. It also suggests that when mathematics becomes an integral part of an integrated science unit, mathematics achievement increases.

These findings are not unique to ULINCS. Michael Klentschy (2001) reported similar achievement gains in the Valle Imperial Project in Science. In his study FOSS and other standards-based, inquiry science modules were used along with integrated literacy strategies that focused on reading and writing. His data reported gains in both reading and writing with the gains increasing the longer the students were exposed to FOSS-like integrated literacy units.

The ULINCS integrated science and literacy approach is based on the belief that young children, like adults, need a purpose to read, to write, to speak, and to apply mathematics. Inquiry science units build common experiences upon which to apply their literacy skills.

The Summary:

The overall benefits from ULINCS can be summarized in a four-parts:

For the teacher:

- Analyze the purpose, process and critical thinking skills inherent within one standard;
- Compare commonality of language and meaning across the standards;
- Write integrated standards and implement the unit.

For the student:

- Start with science inquiry;
- Read both fiction and non-fiction;
- Write up scientific results;
- Make an oral presentation.

For the district:

- Increase standardized test score for both disciplines;
- Create community of learners within buildings and across the district.

For the university:

- Keep theory grounded in school practice;
- Increase research-based action for in-service teachers;
- Hone university/school partnerships.

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Using Literacy Strategies to Plan for Science Content Reading

Pre-Reading	Strategies

Explore/Engage

1. Anticipation Guides
   Introduce each chapter by activating thoughts and opinions/KWL
2. Vocabulary
   Word Splash
   Word Sorts
   Vocab Alert! (Teacher identifies key words from reading, students record information about terms and class discusses after reading)
3. Graphic Organizers
4. Discussion
   Brainstorms
   Exclusion Brainstorms
5. Quick Write
6. Mysterious Possibilities
   (Teacher shows an object, picture, etc. and students solve the mystery by predicting then reading text)
7. I'm Curious
   (Teacher introduces topic, each student generates a list of 3 responses to the question: "What makes you curious about ______?" Video clips may be used also.
8. Question of the Day
9. Factstorming

During Reading

Experiment/Explain

1. Study Guides
   teacher or student made
   2. Two Column Notes
   3. DRTA
   4. SQ3R
   5. Main Idea Maps
2. Paired Guided Reading
3. Pen-in-Hand (Continuum with underlining, notes, graphic organizers, outlining, paraphrasing)
4. X Marks the Spot
   (X= Key Point in text;
   ! = new, interesting information;

? = I have a question; I'm confused)

5. Vocab Marks
6. Venn Diagram (Comparison/Contrast Chart)
7. Idea Maps (Students draw or find a visual to identify the concept and then make a structure for mapping the information.)
8. ROW (Read, Organize, Write)
9. Learning Partner Journal
10. Brainwriting (Like brainstorming, but during reading 3-5 students take notes and read each other's notes after reading.)
11. QAR

12, Concept Collection (Students divide paper into four columns and label: Familiar Concepts, Evidence, New Concepts, Evidence. Before reading, they fill out column 1 by listing what they alreading know about topic. As they read, they record any evidence that support what they know. After reading, they identify and list what they consider new concepts as a result of reading.)

<u>Post Reading</u>

Evaluate/Extend

1. Reaction Guides

   Add a column to anticipation guides for post reading;

   reaction to the same two or three statements
2. KWL
3. Graphic Organizers
4. Discussion Groups
5. Cloze Concept Guides
6. Written/Oral Summaries
7. Assessment of Learning Through Writing, Speaking
8. Mini-Projects
9. I-Search Paper (Macrorie, 1988)
   1. Choose a topic
   2. Carry out the search
   3. Conduct an interview(s)

   4. Write the paper and include these four categories of information:

      *What did you know about the topic before your search for information?

      *Why did you choose this topic?

      *Describe your search

*Describe/discuss what you learned

5. Provide a list of all sources
6. Project Journal
7. Observational Notebook
8. 5 Minute Book Talk on Related Literature Selection
9. Explorer Kit (Collection and explanation of objects, artifacts associated with topic)
10. Investigative Teams-Inform Literature (Like literature circles, but roles are investigative reporter, headline writer, graphic artist, editorial consultant, critic, travel reporter, ad designer, researcher, social columnist. Usually there are 4-5 roles from above are selected, depending upon the topic.)
10. Create Content-Related Picture Books

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