Christa McAuliffe Award
2004 Final Proposal

Name of Program:

Learning through **I**nquiry **S**cience and **T**echnology **(LIST)**

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Describe your program, including its mission, goals, structure, etc.

Learning through **I**nquiry **S**cience and **T**echnology **(LIST)** is a professional development program for science teachers. Each LIST program involves all science teachers, usually 20-25, from a school district. This focused approach to professional development achieves immediate systemic change in the way science is taught and improvements in student learning. LIST programs include all K-12 science teachers in a district or all science teachers within selected schools, depending upon the size of the district.

The south Georgia and north Florida region is characterized as rural, poor, and containing a high percentage of minorities. State averages per school district for minorities (40-50%) and students eligible for free/reduced lunch (45%) fail to resemble actual figures found in this region of the country. Districts in this rural southern area typically have minority populations (>50%) and students eligible for free/reduced lunches (>50%) which exceed state averages. Poverty, isolation, and limited resources characterize the challenging factors that impact learning in this region. The LIST program began in 1998 as an effort to improve student science achievement, the lowest subject area scores on standardized tests in the region. Since that time, LIST programs have been funded through Title II Eisenhower grants (now called Teacher Quality) with considerable matching funds from targeted school districts and Valdosta State University (VSU). Programs have been implemented in the following south Georgia districts – Brooks County, Thomas County, Cook County, Ben Hill County, Echols County, and Valdosta City. Programs in Florida include Madison County and Nassau County. The LIST program was developed collaboratively in the VSU College of Education and College of Arts and Sciences. VSU is located 30 km north of the Florida border. This location allows a LIST program to transcend political boundaries and forge relationships within Georgia and Florida. University faculty members from the Colleges of Education and Arts and Sciences from VSU and The University of North Florida collaborate on programs with Florida districts.

LIST is designed to transform the science teaching culture within a school and/or district from a traditional, teacher-centered orientation to one of inquiry, placing students at the center of their own learning. The mission of LIST is to increase student achievement in science through research-based professional development. LIST programs support this mission by achieving the following goals:

1. provide effective and sustained professional development to K-12 science teachers.
2. implement inquiry-oriented, standards-based curricula that align with state assessments.
3. deepen science content knowledge of K-12 science teachers.
4. strengthen pedagogical content knowledge of K-12 science teachers.
5. increase comfort, skill, and use of available instructional technologies.

There are several key components of LIST that provide the foundation for the program and ensure its success. These components are described below.

Advisory Panel – Each program is planned and implemented by a highly collaborative advisory panel consisting of at least a scientist, an education technologist, four master science teachers, a certified teacher support specialist, two science educators, and a science education graduate

student. In the case of Florida programs, these numbers are doubled as a similar group is established through The University of North Florida to work collaboratively with the Georgia group to jointly deliver the program.

On-Site Delivery – Each LIST program is individualized for the teachers of a district and is delivered entirely in their science and technology classrooms. Program staff travel to the teachers and their schools for all components of the program. This on-site, needs-based aspect of the program increases the comfort level of participants and allows them to become familiar with the science equipment, technology resources, and curriculum materials available to them within their buildings and district.

Teacher/Administration Input – Prior to the first Advisory Panel meeting for a program, the science teachers are administered a survey that provides information on their teaching orientation and technology utilization. LIST staff meet with teachers to explain goals and expectations of the program and to elicit feedback and suggestions from them on desired structure and content of the program. Administrators (principals, curriculum and staff development coordinators, superintendents) are included in all pre-program information gathering. Some administrators, usually principals and curriculum and staff development coordinators, must participate in a majority of the program.

Program Structure/Long-Term Support – LIST programs consist of three phases. The first phase involves an intensive one-week summer institute during which program staff model inquiry science lessons and effective technology integration using resources available to them in their district. The learning cycle is the research-based teaching procedure modeled in the LIST program. It is a student-centered approach to teaching supported by numerous National Science Foundation curriculum development programs. The learning cycle consists of an exploration, concept invention, and expansion. It has proven to be a highly effective teaching methodology. Learning cycle curriculum materials are purchased for the teachers while kit-based materials are made available for loan to them throughout ensuing school years. The second phase involves Saturday sessions (every other week for eight weeks) which begin following the start of the school year in the fall. These sessions are designed to support teachers as they convert traditional lessons to inquiry and incorporate technology. Trouble shooting, support, and continued modeling of lessons by program staff constitute the bulk of these sessions. The third phase involves consistent support by program staff through individual and group sessions the remainder of the academic year. A university faculty member, either a science educator or a scientist, is released from a course during fall and spring semesters and dedicates that time with program teachers. Subsequent programs usually incorporate a teacher from a previous program to further the development of that teacher. These teachers then continue working with colleagues at their schools throughout subsequent years. Initial contact time of all teachers on a program with LIST staff is at least 60-80 hours. Subsequent follow up through contact with their LIST teacher results in each participant receiving 100-150 hours of professional development related to the program.

Website – A LIST website is established for each program that allows for exchange of curriculum ideas, questions for scientists, sharing of resources, lesson plans, and useful links to assist and support teachers implementing inquiry science activities.

What evidence do you have of the program's positive impact on its teacher candidates or in-service teachers?

A thorough evaluation plan is implemented to assess program effectiveness with respect to teacher outcomes. The evaluation plan has substantial formative and summative aspects and places particular emphasis on the domains of cognitive and affective development. Within these two domains, the evaluation instruments primarily measure teacher attitudes and pedagogy. Over 150 science teachers in the region have participated in a LIST program. A typical evaluation timeline for a program is as follows:

March/April – Pre-program: teacher questionnaires and interviews concerning technology use, teaching style, assessment techniques, attitudes toward teaching and students.
July - Intensive summer workshop: evaluations of workshop quality, daily teacher reflections on utility of workshop activities associated with day-to-day instruction in their classrooms.
August/September/October – Saturday follow-up sessions: evaluations of quality and usefulness of Saturday workshops; biweekly teacher reflections on implementation of inquiry teaching strategy, technology integration, and student learning; student interviews concerning teacher use of activities and technology.
November through April – Small group and individual meetings/observations with staff: individual and/or small group interviews concerning implementation of inquiry teaching strategy, technology integration, and student learning; submission of lesson plans for staff to evaluate extent of inquiry and technology integration.
April/May – Post-program: teacher questionnaires and interviews concerning technology use, teaching style, assessment techniques, attitudes toward teaching and students.
Subsequent years – Follow-up questionnaires concerning technology use, teaching style, assessment techniques, attitudes toward teaching and students, student interviews concerning teacher use of activities and technology.

The following data and teacher comments are consistent across all grade levels and districts in which LIST programs have been implemented. They clearly show a positive impact on teacher attitudes and actions in the classroom. Most importantly, this positive impact is pervasive and sustained over the years.

Pre-Program Data – Teaching methodologies are typically very passive. Teacher lectures, student reading, and worksheet completion accounts for approximately 50% of classroom time. If two other passive methodologies are included, watching videos and demonstrations, the number increases to 75% of classroom time. Only about 5% of classroom time includes laboratory activities with another 5% incorporating technology. Discussions and question/answer test reviews generally complete the science instructional picture for LIST program districts. Student assessments are equally traditional with multiple choice, true/false, matching, and short answer comprising about 75% of testing methods. Essays, laboratory practicals, and program-based activities round out the remaining assessment techniques.

Intensive Summer Workshop – The non-threatening and interactive nature of the intensive summer workshop make it a very positive experience for teachers. Teacher summary statistics

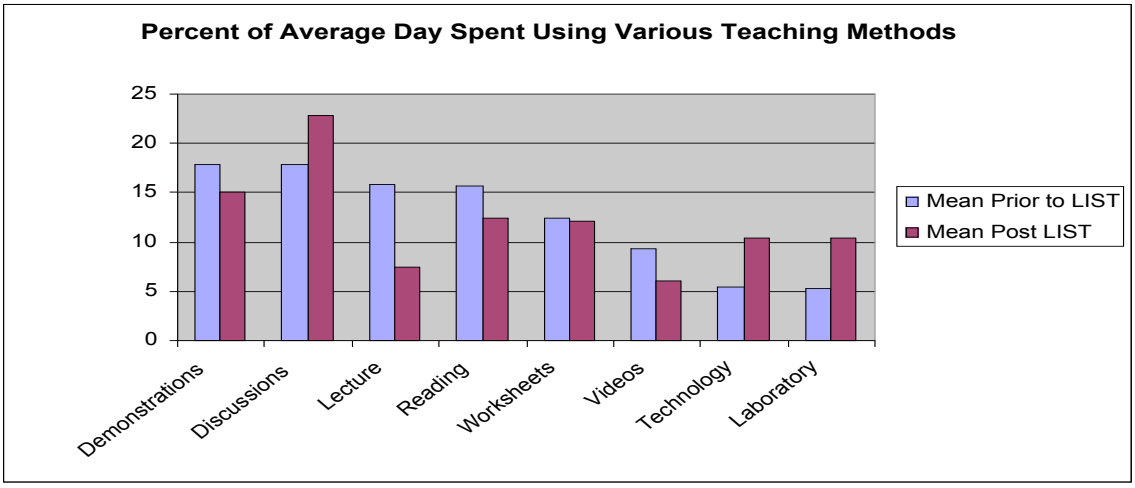
from Madison County, Florida, provided below, are typical and clearly indicate a positive impact on teachers. Responses of "strongly agree," "agree," "disagree," or "strongly disagree" were possible for the following 10 statements about the summer workshop:

1. The workshop goals and objectives were achieved.
2. The workshop provided opportunities to actively participate.
3. Learning cycle and technology information is valuable to teachers.
4. The workshop addressed my individual concerns as a teacher.
5. I am more aware of my students' reasoning processes as a result of the workshop.
6. I understand the learning cycle teaching procedure.
7. I am more knowledgeable about how to use technology in the science classroom.
8. I agree with the presented approaches to teaching and learning.
9. I plan to teach some of my classes differently this year.
10. I will implement workshop ideas into my classes this year.

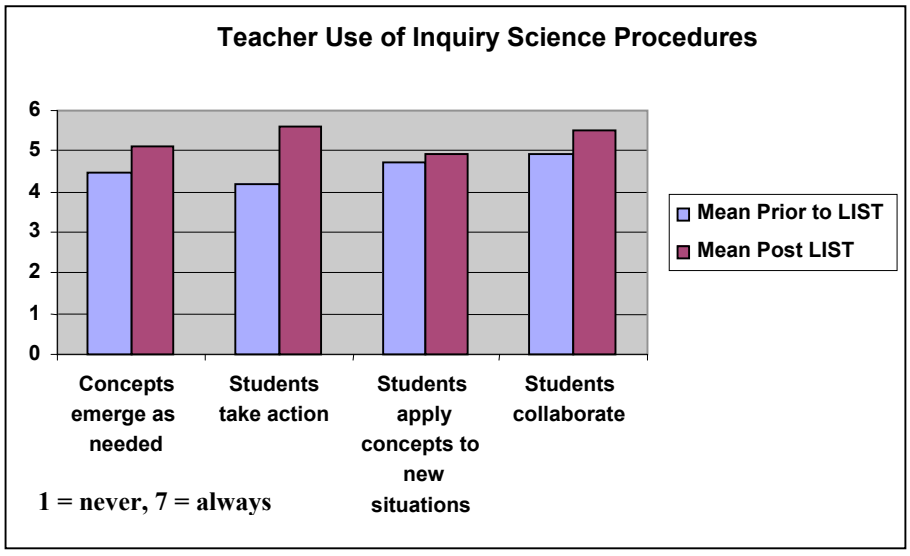
Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
1	70	30	0	0
2	100	0	0	0
3	82	18	0	0
4	41	59	0	0
5	65	35	0	0
6	65	35	0	0
7	59	41	0	0
8	65	35	0	0
9	59	41	0	0
10	71	29	0	0

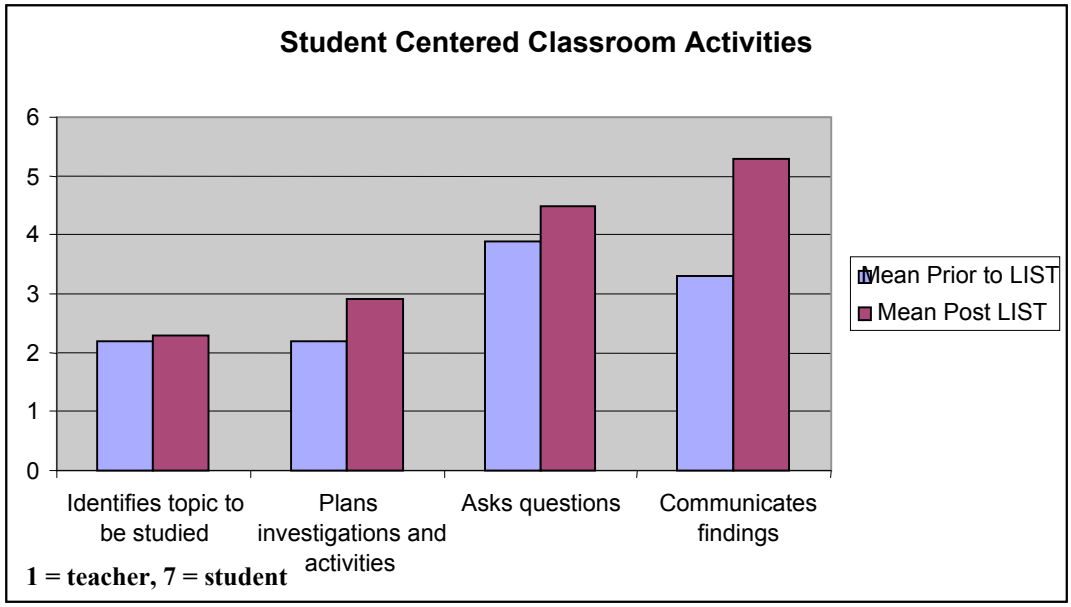
Values shown as rounded percentages of 17 teacher participants in Madison Co. LIST program.

Post-Program Data – One year after implementation of a LIST program, teaching methods of those participating in the program show tremendous movement from a teacher-centered orientation to one in which the students are actively involved in the classroom and contributors to their learning. The chart below, Percent of Average Day Spent Using Various Teaching Methods, highlights pre- and post-LIST data obtained from teacher participants. Post-LIST program data show teachers double technology use and laboratory activities compared to pre-LIST information. Significant decreases in lecture and watching videos is noted. Overall, there is a clear trend of movement from teaching procedures with passive student involvement (demonstrations, lecture, in class reading, worksheets, and videos) to teaching procedures that promote active student involvement in learning (laboratory and technology activities, discussions) as a result of participation in a LIST program.



Additional data on teacher change one year after initiation of a LIST program are highlighted in the following two charts. Teachers provide self assessments of their teaching styles prior to a LIST program and one year after initiation of a program. The first chart, Teacher Use of Inquiry Science Procedures, highlights data concerning four key measures of inquiry in a classroom. Teacher participants rank these items anywhere between 1 – "never occur in my lessons" to 7 – "always occur in my lessons." There is positive movement in all four categories, but it is especially apparent in one of the most important, "students take action." A key to inquiry teaching is ensuring students are actively engaged in exploring science materials so they may discover concepts for themselves. The LIST program is able to modify teacher behavior in the classroom so as to increase the amount of student action in the classroom, a foundation for inquiry teaching. The second chart, Student Centered Classroom Activities, highlights the extent to which students are involved in class activities. Teacher participants rank these items anywhere between 1 – "teacher most often" to 7 – "student most often." The four categories listed are typically found in inquiry-oriented classrooms. There are positive gains in all four areas but especially noteworthy are gains in the category of allowing students to communicate their findings. This is a vital step in inquiry as it allows students to reflect and modify their understandings as they discuss and defend their findings and conclusions with the class, a key to student ownership of content.





Most importantly, long-term follow-up evaluations of about 75 past participants show nearly 100% of teachers from previous programs continue to use the learning cycle teaching procedure and meaningful technology integration in their instruction years after participation in a LIST program. It is this continued use of the learning cycle, technology integration, and the establishment of a culture of collaboration, that allows teachers to continue skill and content development in subsequent years resulting in sustained student achievement. Additionally, teachers report in long term follow-up evaluations that participation in a LIST program has impacted their classroom in other ways, such as:

- extensively involving students in the learning process
- producing deeper understandings and greater retention of knowledge
- improved classroom management
- thinking and communication skills development by students
- basing teaching on learning theory supported by empirical data
- making science relevant and meaningful to students

An external evaluator was hired for the Florida programs with the primary goal of qualitatively evaluating LIST impact on 1) teachers and their teaching, and 2) students and learning. Small group interviews, email questionnaires, and large focus groups were used to collect data. Findings on teachers and their teaching show a significant positive impact on teachers. The following themes emerged from teachers during data collection:

- commitment for systemic change is in place
- teaching is more student-centered, small groups, more individualized coaching
- increased interaction between student and teacher, questions about science beyond the "lesson"
- greater interest in student thought processes
- greater use of student background knowledge
- increased expectations for student thinking
- increased use and effectiveness of technology

A final piece of data used to triangulate the positive impact on teachers as a result of participation in a LIST program is from the voices of the teachers themselves. These data were collected through open ended questionnaires and reflective writings gathered during various stages of a program and during long term follow up data collection. Primarily, the teachers described efforts to incorporate both inquiry and technology into science lessons. As time passed and they continued to implement new activities, their comfort level rose. Teachers used words like "empowered", "energized", and "motivated" to describe their feelings about teaching science. All teachers stated they were using both inquiry and technology more frequently and with new confidence. As a result of changes in their teaching, students were more excited and motivated and there were fewer discipline problems. Many commented on cooperative learning activities, indicating they promoted student interaction as they shared knowledge and helped each other understand the concepts. For many, it was a giant step to put students in cooperative groups, overlook an increased noise level, and guide students in discovering for themselves rather than telling them what they were to know. Once accustomed to this classroom environment, teachers frequently noted this allowed them to move around the room and "finally reach" all of the students. The quotes below are from actual participants but are representative of common themes found in these data.

"Science inquiry methods will definitely change my method of teaching... my change to using this method will be gradual as I have been drilled in lecture, read, notes, but the change will definitely be done."

"I'm looking forward to more, more, more, and more. It has helped spark a fire in me that might have been burning out!"

"It blew me away that there could be so much neat technology integrated. It really livens up the class."

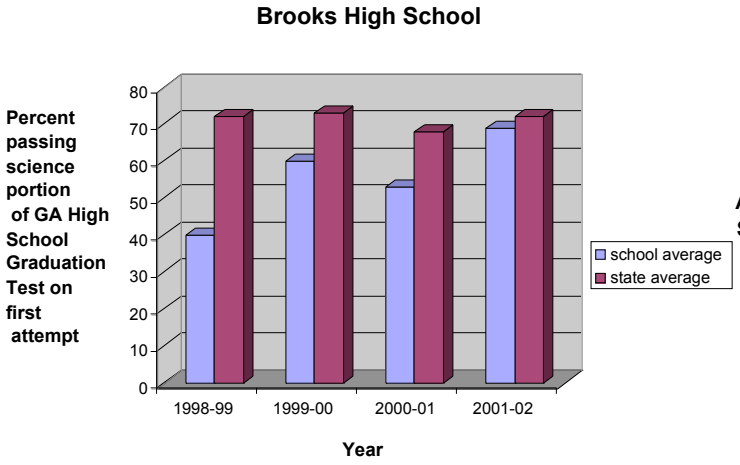
Numerous teachers have won their district "Teacher of the Year" awards following involvement in a LIST program, the most recent involving a program this past year. A participant from three years ago not only was named Teacher of the Year for her district but was a finalist for National Science Teacher of the Year honors. She has also been a staff member of LIST for the past two years. Several others have gone on to receive National Board Certification. The following quote is from a participant's cover letter to the National Board for Professional Teaching Standards but summarizes the typical feelings of LIST participants.

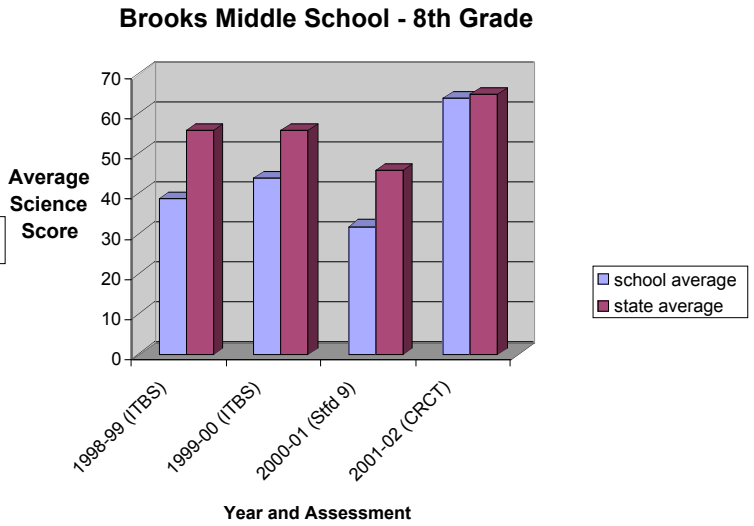
"I am an energetic life long learner who seeks out opportunities to strengthen my skills and techniques. I keep an open mind about new ideas, how I can transfer my learning to the classroom, and how what I've experienced might be useful to a colleague. I have attended yearly professional conferences in the area of science and/or technology, and have participated in many workshops. All of the workshops and conferences have provided an opportunity for me to grow and transfer knowledge back to the classroom, but nothing has ever had such an impact on me, my teaching, and my students, as a program I began in the summer of 2002, "LIST" –Learning through Inquiry Science and Technology."

What evidence do you have of the program graduate's positive impact on P-12 pupil learning?

The LIST program has documented success in improving science learning with P-12 students. This positive impact has been measured through 1) teacher participant reports on their students, and 2) standardized test scores. Since a LIST program targets all science teachers within a district or building, we are able to examine science-related standardized test scores without the need to track individual students through different teachers. This simplifies the data collecting/reporting issues and minimizes the potential for error. The goal of LIST is to improve student achievement for the entire student body of a school or district in science. Since their inception in 1998, LIST programs have impacted over 35,000 K-12 students.

Example test data trends are highlighted below. They show the district or school and show standardized test score improvements over time. The data provided are representative of LIST program student achievement results.

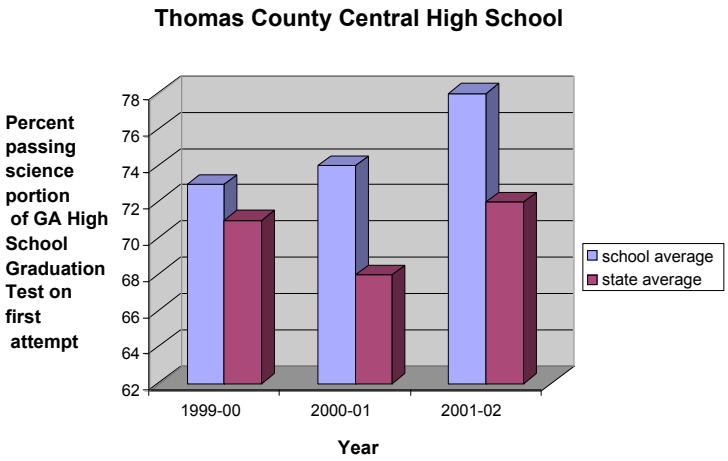


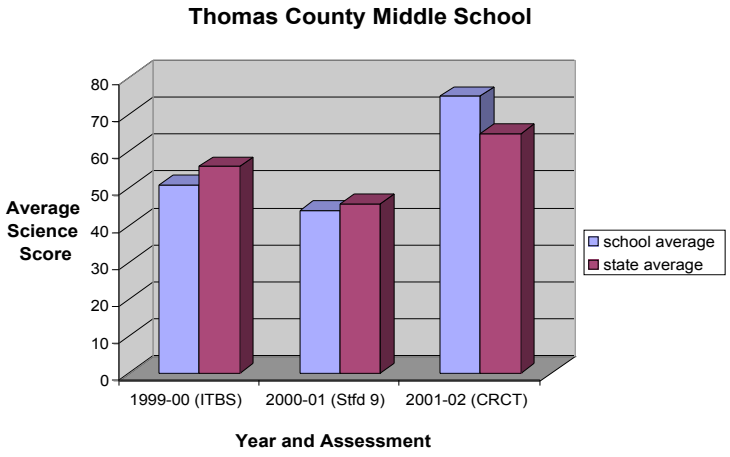


Results from the Brooks County LIST program, initiated in 1998 with the high school and middle school, are indicative of those achieved in high minority, low socioeconomic status districts. Brooks County Schools contain 65% minority students and 75% eligible for free/reduced lunches. Following initiation of a LIST program, the percentage of students passing the science portion of the Georgia High School Graduation Test on their first attempt significantly increased. Similarly, scores for the science portion of eighth-grade standardized tests show a gradual closing of the gap between the state and school averages. Most importantly, this positive impact is sustained over time demonstrating a LIST program will continue to impact students long after the program in that location has ended.

Data in the following figure from the LIST program initiated with Thomas County Central High School and Middle School in 1999 show similar results to those found for Brooks County. Science student test scores, relative to state averages, show improvement that is sustained over time. What is especially striking about these results is that student science achievement, prior to beginning a LIST program, was above the state average for the high school. Following initiation of LIST, achievement gains strongly outpaced the state average. The needs-based nature of LIST

allows for tremendous student achievement gains to be made regardless of current achievement levels.





These achievement data are supported by teacher observations of their students. The following themes are consistently found among responses by participants of past LIST programs in follow-up questionnaires. As a result of their involvement in the LIST program, their students are:

- using the inquiry learning cycle strategy
- actively involved in the learning process
- demonstrating deeper understanding and greater retention of concepts
- showing higher student achievement
- requiring less classroom management intervention
- developing better thinking and communication skills
- understanding the relevance of science to their daily lives

These data are also triangulated with external evaluator findings for the Florida programs. The following themes emerged from their data collection regarding student achievement as a result of teachers participating in the LIST program. Students are:

- engaged in their learning and take greater responsibility
- able to see the big picture of content and how it relates to the real world
- increasing the involvement of their parents in science classroom activities
- working more with peers and groups
- feeling more confident in their abilities

An additional confirmation of student achievement is the use of a pre- and post-test on a content unit. Teachers construct, with the assistance of program staff, an assessment to be used as a pre- and post-test of a science unit incorporating inquiry and technology teaching strategies. Pre-tests are administered to students prior to introduction of the units and post-tests are administered following completion of unit activities. Units have lasted from a few days to several weeks. The following table, with data from the Madison County LIST program, shows significant improvement in student mean scores from pre-test to post-test and is representative of student achievement data found by teachers in all other programs.

Student Pre- and Post-test Scores

Grade	N	Mean pre-test	Mean post-test	Difference
4	38	45	76	+31
5	65	39	75	+36
7	31	20	75	+55

A final piece of data used to triangulate the positive impact of LIST on P-12 students is from the voices of their teachers. These data were collected through open ended questionnaires and reflective writings gathered during various stages of a program and during long term follow up data collection. Teachers are sensitive to changes in their students long before standardized test score data are released. The quotes below are from actual participants about their students but are representative of student achievement themes found in these data.

"My classes have already moved from a C average last year to a B average this year. I have noticed much more student involvement and many more Oh's (i.e., Oh, I get it now)."

"The kids seem more excited about science. Parents and other teachers are telling me this."

"The kids are learning better by discovering and exploring on their own. I don't need to stand in front of the class and read/lecture from a book. Even though they are kindergartners, they can still discover things on their own. I don't need to give them a worksheet to check for understanding."

The following letter is indicative of the respect the LIST program receives from administrators participating in the program and examining results it produces within their district.

"On behalf of the Nassau County School District, please accept my appreciation for your work with our science teachers over the past year through Program LIST/Learning through Inquiry Science and Technology. The program has been extremely effective in creating a network and collegial learning community among teachers at six schools that are quite diverse and geographically spread out across our district. Additionally, the quality of classroom instruction for students has been positively impacted by your modeling and demonstrations and by participants' subsequent learning, implementation and reflection. We are pleased that in the first year of testing for science standards, our FCAT Science achievement data show our district mean scale score to exceed the state mean at both the 8th and 10th grade levels. This program has been an outstanding example of the state of Florida's rigorous criteria for highly effective professional development, as specified in the Florida Staff Development Evaluation Protocol. Therefore, as a result of Program LIST, it is an honor to nominate you...for the Florida Association for Staff Development's annual award for Outstanding Staff Development Practices."
- Assistant Superintendent for Staff and Program Development, Nassau County, Florida

LIST was awarded the 2003 Most Outstanding Staff Development Award in the state of Florida by the Florida Association for Staff Development. This award was based on the significant impact the LIST program has made, and continues to make, on teacher change and student achievement.