Brain-Based Accelerated Learning Longitudinal Study Reveals

Subsequent High Academic Achievement Gain for

Low Achieving, Low Cognitive Skill Fourth Grade Students

By Jan Kuyper-Erland

Abstract. Three earlier published reports (Erland, 1999c, 1999d, 1998) of a two school (Schools 1 & 2), 14 classroom, grades 4-8 study, reported large gains evidenced by the Brain-Based-Accelerated Learning (AL) application of The Bridge To Achievement (The BTA). Eleven BTA/AL experimental groups were compared with two control groups from School 2 having an Alternate Media Activity (AMA), and a no-treatment comparison/control group from School 1. There was a wide range of policy adherence (98% to 25%) for the eleven experimental classrooms to the 19 Executive Criteria.

Analyses of academic achievement was measured by the Iowa Tests of Basic Skills (ITBS) and cognitive skills were measured by CogAT (subtest of the ITBS), and eight subtests, four each from The Woodcock Johnson Psycho-Educational Battery-1, and The Detroit Tests of Learning Aptitude-2.

This report is a follow-up investigation of two of the original three fourth grade treatment classes of School 2 (n=44); 4E1, i.e. grade 4 - Experimental, class 1 (n=24), and 4E2 i.e. grade 4, Experimental, class 2 (n=20). A majority of these students had low auditory memory n=40/44. Each class had a subset of students with severe cognitive skill deficits 4E1=10, 4E2=7, two class sum: n=17/44 students. Except for one student who did not have cognitive skill deficiencies, the remaining 43 students had specific isolated auditory or visual memory encoding-decoding weaknesses.

The report investigates the effect the subset of 17 low achieving/cognitive deficit students had on the score performance of the entire class as an aggregate group. Further intra-analyses looked at these 17 low students and factored out the lowest five, (4E1), and four, (4E2), from each group, classifying them as "outliers". These outliers greatly skewed the national ITBS scores by as much as 50%. Tables 12-15 show these comparisons.

These two classrooms were in the top five classes that had followed the Executive Criteria policy successfully, 68%-54%. The 4E1 and 4E2 classes hovered at, or were just above, norm level proficiency for three consecutive years pre- and posttest to The BTA - Accelerated Learning (BTA/AL) intervention. Falling below norm expectation gains posttest after training would lead to the assumption that the BTA/AL treatment had not been successful.

However, when these two 4E1 and 4E2 classroom were pooled posttest with the "star" high performing 4E3 class against national norm (NN) expectations, ten of the thirteen ITBS subtests for 4E1, and nine of the thirteen primary ITBS subtests for 4E2, were statistically significant showing positive

trending. Furthermore, removing the nine "outliers", revealed both classrooms were now above the norms, having made gains posttest.

One year longitudinally, and still pooled with the "star" 4E3 class, and with the outliers included, the 4E1 class had all thirteen primary ITBS subtests statistically significant, and the 4E2 and 4E3 classes had 12/13 ITBS primary subtests statistically significant. This indicated longitudinal ITBS score maintenance for all three experimental fourth grade classrooms. 4E1 and 4E2 were now performing at, or slightly above, grade level in 14/16 ITBS subtests, with one-year above grade level in Language Total and Science. These two classes surpassed the 5th grade controls' one-year longitudinal Standard Score point Differences (DSSs) for Core Total, Social Science, and Science.

Two years longitudinally, the two 4E1 and 4E2 classes (School 2) revealed large academic achievement gains. Academic achievement had been previously at, or slightly above, grade level for the three pre-training, and post-intervention years (grades 3, 4, and 5), they were now above grade level entering grade 6, whereas beginning grade 7, performance was now +1 to +3 1/2 years above grade level in all sixteen ITBS subtests. These increases included: +1 1/2 - 2 years' gain in Reading and Math, + 2 1/2 years' gain in Composite, Language Total, and Science, to +3 1/2 years' gain in Social Science. These scores included the nine very low "outliers". Comparatively, two years later, School 1's "star performing" 4E3 class surpassed that school's fourth grade comparison class by one year's additional growth (both classes had the same pre- and posttest teachers).

Following the BTA/AL training, and unlike School 1's 4E3 class that remained as a yearly intact group, the 4E1 and 4E2 students were randomly assigned to 5th and 6th grade classrooms. Two-year longitudinal DSS comparisons of the 4E1 and 4E2 students show greater change by the 4E2 class, particularly in Vocabulary, Reading Total, Math Problem-Solving, and Science, which eventually surpassed the DSS scores of both the 5th and 6th grade Control Groups. The students were dispersed, did not remain as intact groups, and the 4E2 class DSS scores were greater than 4E1 DSS scores. This gives credence that this score increase as due to the earlier BTA/AL intervention, and can not be attributed to chance of the subsequent fifth and sixth grade conventional instruction.

These latent effects in academic achievement growth following immediate cognitive skill improvement with low scoring students, had been seen many times by this researcher (Erland, 1999c, 1998, 1994, 1989b). A student intra-analyses was conducted to determine what point in time these gains in growth occurred, whether gains occurred for all the low achieving students, including the "outliers," to what extent, at what point in time the change occurred, and what elements caused these changes.

Overview

Three preceding JALT articles (Erland, 1999c, 1999d, 1998), demonstrated how a two school study of Brain-Based Accelerated Learning that included eleven experimental classrooms, compared to three control groups, obtained statistically significant gains in all academic achievement areas, measured by the nationally standardized The Iowa Tests of Basic Skills, (ITBS).

The study expanded on practical applications of Sternberg's Information Processing and Intelligence Theory (1991,1985), Erland's Hierarchy of Thinking Model (1989c), Bandura's Social Learning Theory (1986; 1971), Guilford's Structure of Intellect (1986, 1967), Lozanov's Accelerated Learning (1978), and Ayres' (1972) Sensory Integration. The BTA model develops 24 primary cognitive skills and learning abilities. (See Erland, 1999d, 1994, 1989a for complete review of the literature and methodology. Earlier issues are available on www.memspan.com under JALT articles.)

Two Midwestern parochial schools from different church denominations comprised this study: School 1 and School 2. The ten-week study applied a video- and audio-tape media and workbook practice (30-40 Minutes daily, Mon-Fri), called The Bridge To Achievement (The BTA), to the experimental groups. The Bridge To Achievement media application includes automated Accelerated Learning (AL) methodology with sequencing-logic skills and pattern-finding lessons that were drilled with a repetitive rehearsal format.

The two fifth and sixth grade control groups had a comparable Alternate Media Activity (AMA) of similar print activities many on video- and audio-tape taught conventionally. A third classroom, a fourth grade from School 2 that did not have BTA or AMA tatment, served as a no-treatment comparison-control group.

The two-school study revealed statistically significant one- and two-year longitudinal results for both schools. This included Reading, Math, Spelling, Social Studies, Science, and Language Arts.

Eight experimental groups and the two 5th and 6th grade control groups remained at the schools for the one-year longitudinal follow-up report. Although School 2 had conducted ITBS testing in the Spring, so had their second year longitudinal data submitted and evaluated for the earlier published

reports, School 1 could not participate with this second follow-up because they tested their students in the Fall.

This one-year longitudinal data revealed 58 statistically significant gains for the eight experimental groups on 13/16 primary ITBS subtests, with two statistically significant gains for just the 6th grade control group (the 5th grade controls had no statistically significant longitudinal gains). Two years longitudinally, the 4E3 class excelled an additional one-year gain over the fourth grade comparison group (Erland, 1999a).

With the subsequent submission of the two-year longitudinal data from School 1, it remained a question why the two 4E1 and 4E2 classrooms were the only experimental the classrooms to fall below the norm expectations on the immediate posttest following BTA/AL media intervention. Yet, these classes showed statistically significant trending when pooled with the "star" 4E3 class both posttest (see table 2) and one-year longitudinally. For longitudinal tracking, the 4E1 and 4E2 classes had all primary 13/16 subtests statistically significant, with the exception of the Math Computation subtest by 4E2 (Erland, 1999c; 1999d).

An Inter-Class analyses comparison for the 4E1 and 4E2 classes without the 4E3 class was essential to determine if one class performed ahead of the other, and if they did, why this happened, in which academic subtest areas did this occur, and what was the long range outcome.

Additionally, an Intra-Class analysis of each student was to analyze:

- If all students made gains on the CogAT
- If all of the low cognitive skill students made equal or similar academic achievement gains over time
- If there were students that should be classified as "outliers". If so, what effect did the "outliers" have on the ITBS standardized achievement test scores
- If there were students who did not make gains
- To what extent were the gains made, and were they maintained
- At what point in time did the growth changes occur

Design, Materials, and Subjects

In the original research study, the combined two-school pre-post experimental and quasi-experimental design study was for students in grades 4 - 8 including all learning levels. Each school had

its own experimental design: School 1 was a Quasi-Experimental design, as they had intact classrooms, grades 4-8, and one non-treatment control/comparison group. School 2 was an Experimental Design with 5th and 6th grades control groups that received an Alternate Media Activity (AMA) for ten weeks. The BTA and AMA materials and hardware requirements are listed in Erlands (1998) report (pp. 20-21).

The experimentals (Es) were matched with the controls with ten weeks of similar instruction using The Bridge To Achievement (The BTA), a non-commercialized, cognitive skills inter-active media program, but applied with Accelerated Learning (AL) techniques.

Two Midwestern parochial schools, referred to as School 1 and School 2, volunteered to serve in this pilot study. The students resided in a Midwestern light industrial mid-size city (pop.150,000). They came from mostly Caucasian, Middle-Class, college-educated parents. Many of the households owned computers.

School 1, a Pre K-8 school, had 97 participating students, grades four to grade eight, and were in intact classrooms, one class per grade level, moving forward each year. School 1 formed the quasi-experimental study, although there was a comparison/control 4th grade classroom.

This report focuses on two fourth grade experimental BTA classrooms from School 2. It was a K-8 school, with 172 participating students, grades four to eighth grade with two classrooms per grade. The two schools combined had 269 participating students. Since the schools volunteered to participate in the study before school began, students were randomly assigned following the teacher in-service training. School 2 became an experimental study.

Control groups: In the original study, there were three control groups. Since School 2's fourth grades did not have a control group, the analysis for this report is a comparison with the norm expectations.

However, School 1 had a no-treatment fourth grade control/comparison class of twenty-three students. These experimental and control group students had the same third grade teacher for the pretest analysis and baseline and moved yearly as intact groups.

School 2 had two classrooms (a fifth and sixth grade) serving as Alternate Media Activity (AMA) control groups. The fifth and sixth grade AMA control groups had twenty-six and twenty-two students respectively. The three classrooms from the two schools totaled 71 controls.

Demographics

School #1:
97 of 118 students participated in the study.
Unchurched - 18%, Christian (all denominations) - 82%, Economically disadvantaged - 19%
Minority - 17% (Asian, Afro-American, Hispanic, and other)

School #2:
172 of 190 students participated in the study.
Unchurched: None, Christian – 100%, All denominations accepted; not exclusive
Economically disadvantaged - 8%, Minority - 7% (Asian, Hispanic, and other)

The Classroom Labeling System

Classrooms were labeled experimentals and controls, E & C, and by school, 1 and 2.

School 1 was experimental 3, or E3. Adding the grade makes 4E3, 5E3, 6E3, 7E3, and 8E3. School 2, with two classrooms per grade, were labeled experimental 1 & 2, or E1, and E2. Similarly, these classes became 4E1 and 4E2, 5E1, 6E1, 7E1, 7E2, & 8E1. This report focuses on two classrooms: 4E1 and 4E2 from School 2.

The control groups were designated as 4th grade controls, (from School 1) 5th and 6th grade controls (from School 2).

The Nationally Standardized Achievement Test

The Iowa Tests of Basic Skills (ITBS) standard score means for each of thirteen out of a total sixteen primary subtests (Frisbie, 1999) were analyzed for comparisons with the fifth- and sixth-grade control groups of School 2, with a no-treatment control/comparison fourth-grade class from School 1. They were also compared against the National Norm Expectations (NN) (Riverside 2000, 1994).

The standard score means of the following sixteen primary subtests were included:

Composite, Reading Comprehension, Vocabulary, Reading Total, Math Concepts, Math Problem Solving, Math Total, Math Computation, Language Total, Spelling, Core Total (Reading, Math, and Language composite), Social Science, and Science. The three Language subtests of Punctuation, Capitalization, and Usage subtests were analyzed only when the added information was applicable.

The ITBS-CogAT. This combined test is designed to predict student cognitive skill aptitude. The CogAT scores can help educators identify strong and weak areas of cognitive functioning for each student. Therefore, instruction can be directed toward students' weak skill areas expediently. The cognitive skills measured by the test reflect the strategies that enable students to solve problems or learn new tasks without direct instruction (Riverside Technical Summary 1, p. 44). The CogAT content:

The CogAt Verbal Tests	The CogAT Quantitative Tests	The CogAT NonVerbal Tests
• Oral Vocabulary	• Number Series	• Matrices
• Verbal Classification	• Quantitative Relations	• Figure Analysis
• Sentence Completion	• Number Series	• Figure Analogies
• Verbal Analogies	• Equation Building	• Figure Classification-1
• Verbal Reasoning	• Quantitative Concepts	• Figure Classification-2

The Nationally Standardized Cognitive Skills Tests in Addition to the ITBS-CogAT

Eight standardized cognitive subtests from two different batteries were selected to measure each student's abilities. Four subtests were selected from the Detroit Tests of Learning Aptitude - Revised 2 (DTLA-2), (Hammill, 1985), and four subtests were chosen from the Woodcock Johnson Psycho-Educational Battery-1 (WDJ-1). Woodcock, & Johnson, 1977). Five subtests were selected to measure successive processing, and three subtests were chosen to measure simultaneous processing (Kaufman & Kaufman, 1983), see figure 1. Earlier versions of these standardized tests were used to maintain an accurate longitudinal data base begun in 1982, and revised with the addition of the Woodcock Johnson Psycho-Educational Battery in 1985.

Woodcock-Johnson Psycho-Educational Battery (1977, 1978), Cognitive tests Part I, based upon Woodcock's Level of Processing, 1978 (See Figure 1) has two subtest clusters: 2 & 7 Visual Speed. Reliability .91 with over 4000 subjects
3 & 10 Auditory Memory. Reliability .90 with over 4000 subjects

The Detroit Tests of Learning Aptitude-2, (Hammill 1985)
Subtests: 3 Oral Directions, 4 Unrelated Word Series, 10 Word Fragments, 11 Letter Sequences
Reliability range .86 - .97; Validity range .53 - .74

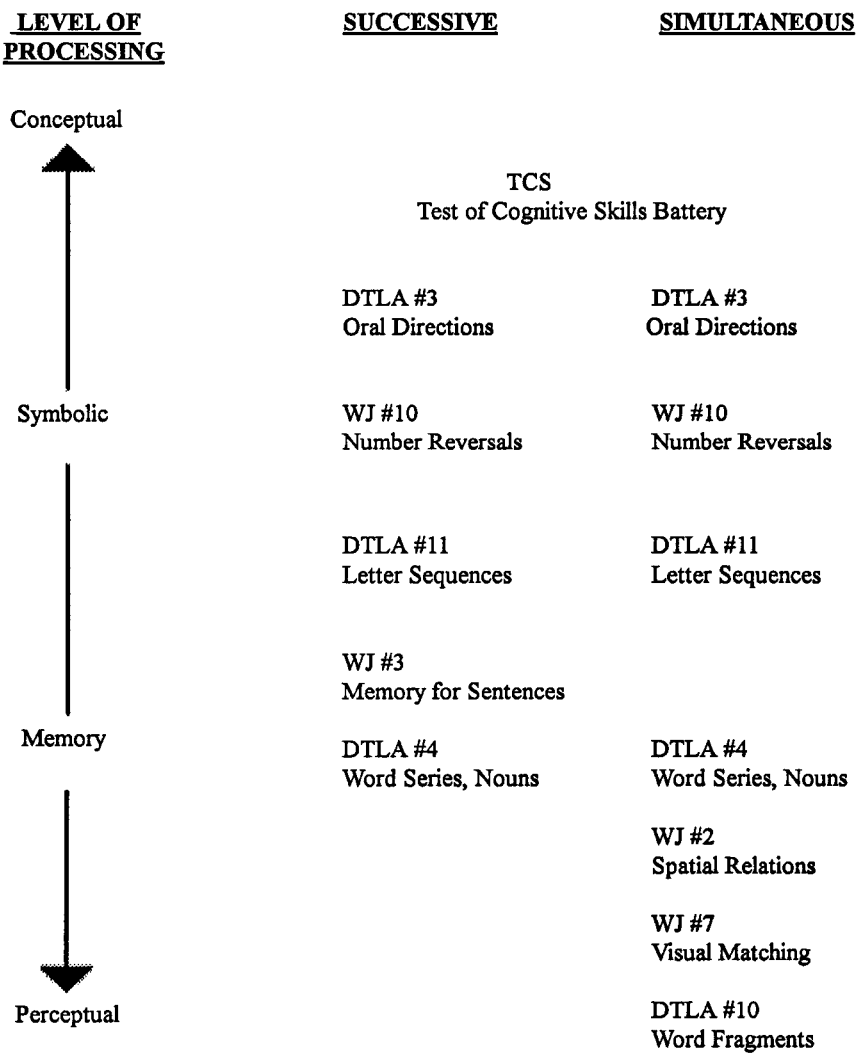
The WDJ-1 tests were administered as pretests only to obtain a visual and listening memory baseline for each classroom.

The five subtests measuring successive processing were: DTLA-2 No. 04, Memory for Unrelated Word Sequences; and WDJ No. 03, Memory for Sentences., Auditory Memory For Sentences; WDJ No. 10 Number Reversals; DTLA-2 No. 11 Memory For Letter Sequences; and DTLA-2 No. 03 Following Oral Directions.

The three subtests measuring simultaneous processing were: DTLA-2 No. 10, Visual Closure Word Fragments; WDJ No. 07, Visual Speed Number Match; and WDJ No. 02, Visual Memory For Spatial Designs. These analyses were based on raw scores, derived from the four subtests giving a composite IQ score.

At the conclusion of the ten-week treatment period, the same cognitive DTLA-1 tests were re-administered to the students. Post-testing procedures, identical to the pre treatment testing, were administered and scored by the classroom teacher. One DTLA-1 subtest, Auditory Memory for Words, was administered individually. DTLA-2 subtests Nos. 3, 10, and 11 were administered as group tests.(See figure 1, Woodcock's Levels of Processing).

figure 1



TCS = Test Cognitive Skills, Sullivan, Clark, and Tiegs, 1981
Based upon the California Maturity Scales
DTLA-2 = Detroit Tests of Learning Aptitude, Hammill, 1985
WJ = Woodcock Johnson Psycho-Educational Cognitive Skills Battery,
Woodcock and Johnson, 1978, 1989

Based upon Johnson & Myklebust's information processing hierarchy theory (1967), and adapted from Woodcock's level of processing theory (1978).

Policy Adherence to the Executive Criteria Factors

A four-tiered resultant outcome effect was analyzed according to how well the eleven experimental BTA classrooms applied the nineteen BTA executive criteria measures when coupled with daily classroom instruction. These criteria ranged from Ideal Conditions (98%-98%), to Good Conditions 77%-63%), Fair Conditions 50% - 43%), and Poor Conditions (30%-25%).

The four levels are described as follows: (See Table 2).

Ideal Conditions include a committed teacher achieving outstanding results in small, carefully controlled group settings by applying all of the criteria most of the time daily for thirty to forty minutes. Former highly successful studies by this researcher and other committed teachers serve as the baseline for observing ideal scientific conditions (Erland, 1999d, 1998, 1994, 1992, 1989a 1989b).

Good Conditions include diligent classroom teachers who followed most of the Nineteen Executive Criteria, applied the accelerated learning strategies, and successfully obtained positive results (Erland, 1994, 1992). This group included the two 4E1 and 4E2 classrooms who evidenced a 73% success rate even with nine outliers, and seventeen very low cognitive skills students.

Fair Conditions include classroom teachers who followed some of the Nineteen Executive Criteria receiving limited results. A baseline of fair conditions requires only that 50% of the criteria be applied for two to three months.

Poor Conditions include classroom teachers who typically cut too many lessons, items, and days, eliminated accelerated learning strategies, and thereby received limited results.

The compilation was made by listing whether they followed the nineteen executive criteria 1/19, and also by Differential Weights according to importance. Evaluation to measure compliance on

the nineteen executive criteria was mode on teacher checklists through site observations and telephone review sessions.

The top three classes that followed the applications correctly had an 82% success rate. Even the two classrooms which had adhered to policy minimally (30%-25%), still evidenced some gains (and beyond what was routinely received), showing the strength of Accelerated Learning practice (Erland, 1999d, 1999c). Earlier Accelerated Learning research indicates that there can be positive results even if the teachers implement the AL methods jut 50% of the time or more (Schuster & Gritton, 1986).

The executive criteria measures required ten-weeks' of daily BTA/AL or AMA treatment for thirty to forty minutes. Unfortunately, to expedite the training, some experimental classrooms cut

training days, and either shortened, doubled-up, or eliminated BTA lessons and Accelerated Learning techniques, directly affecting their outcome results, and also giving a circumstantial edge to the control groups.

The 4E1 and 4E2 classrooms followed policy 54%-68%. Although they qualified as having received "Good Teaching Performance," the seventeen low performing students, including the nine outliers, affected the experimental outcome of these two classrooms.

The ITBS academic subjects that were most directly affected by low compliance of BTA/AL policy were the Reading, Math, and Science subtests, particularly the 4E1 and 4E2 classrooms having the low cognitive skills-auditory memory students.

Due to altered BTA/AL application, these students also achieved lower auditory memory gains (Erland, 1998). Reading, Math and Science require sufficiently functioning cognitive skills, which include good auditory and visual memory integration needed for conceptualization (Meeker, 1991; Erland, 1989c; Reid and Hresko, 1981; Woodcock 1978; Ayres, 1972).

The BTA cognitive skills training, accompanied by Accelerated Learning techniques, is designed to make all primary learning pathways (visual, auditory, tactile, kinesthetic) operational. Additionally, the strengthening and lengthening of the memory spans (both auditory and visual) creates the agile learner by The Hierarchy of Thinking model (Erland, 1999, 1998, 1994, 1989c). The long, strong visual and auditory memory spans develop mental resiliency for learning efficiency through encoding-decoding practice (Erland, 1998, 1995, 1994, 1992, 1989a, and 1989b). This BTA/AL training in pattern-detection and sequencing skill move beyond learning facts through mere rote memory drill (Erland, 1998, 1995, 1994, 1992, 1989a). This methodology is a type of "*Brain-Based Learning*".

Method

The complete method and procedures of The Bridge To Achievement (The BTA) for the experimentals, and the Alternate Media Activity (AMA) training for the controls, appear on pages 30-39 of the published comprehensive monograph (Erland, 1999d, JALT Fall 1999; Erland, Fall 1998).

The BTA media-driven 48-day instruction (24-hours) was comprised of video- and audio-tapes, work sheets, and transparencies for the overhead projector. Each student received a daily worksheet lesson for the thirty brain building lessons taught in scope and sequence. Four upper level lessons instructed how to follow written and oral directions, leading to critical thinking.

The BTA consists of whole-brain, inter-sensory instruction for 30-40 minutes daily, Monday-Thursday, in a drill-practice format, divided time-wise among the various academic subjects. The practice included Accelerated Learning use of dramatization, rhythm, and choral speaking with positive affirmations.

For review, the following Accelerated Learning Principles and the nineteen Executive Criteria are detailed below.

The following fifteen *Accelerated Learning and Suggestopedia* principles (Fairbanks, 1992) applied in the 1996-1999 two school, 11 experimental & 3 control classroom field test:

- Utilizes speaking in rhythm and short phrases
- Applies imagery and visualization
- Addresses the physical environment, including seating arrangements
- Uses motivational exercises
- Applies positive affirmations
- Addresses barriers to learning
- Orchestrates playful multi-modal learning
- Uses active presentation in learning
- Is compatible with how the brain works
- Employs creativity
- Accommodates diverse learning styles
- Empowers, respects and supports learners
- Emphasizes relationships and systems thinking
- Maximizes utilization of training time
- Applies methods of relaxation through creativity

Fairbanks, D. M. (1992) The Basics of Accelerated Learning. Alexandria, VA: The American Society for Training and Development

Prescriptive BTA/AL Instruction : The BTA Nineteen Executive Criteria Measures.

1. All lessons should be taught according to scope and sequence for 48 consecutive days (24 hours of training, Monday through Friday), according to time and task.
2. Student attendance and active participation were mandatory. Students absent more than seven days were to be removed from the study. Students were to be not removed from the class for other Special Services instruction during the training.
3. Trained substitute teachers were to be used when teachers were absent.
4. All lessons, and lesson items, should be taught in proper sequence, without skipping or doubling any lessons.
5. Recitation applied.
6. Role-playing and dramatizations by the students implemented.
7. All lessons were to be taught according to instructional lesson plan and procedure.
8. Students to work in partners or triads.
9. The BTA instructional lesson plan concordance system applied according to policy.
10. Pattern detection instruction applied.
11. Visualization techniques applied.
12. Peer models engaged.
13. Rhythm and kinesthetic motion applied.
14. Maintain students' rapt attention and engagement in the activity.
15. Latin Roots lesson rehearsal applied.
16. Positive self-affirmations applied.
17. The teacher giving positive examples of rationale for each activity enthusiastically ("tells why").
18. Seating rotated so the video monitor was in close proximity for all students in varying schemas.
19. Room lighting consistent, with the monitor visible. Room heating at a comfortable setting.

Two-year Longitudinal Results for 4E1 and 4E2 Classes

This report is to analyze the effects of two fourth grade classrooms (n=44) with low auditory memory (40/44) with two subsets of low cognitive skill profile students in classrooms 4E1 (n=10/24 students, 42%) and 4E2 (n=7/20 students, 29%), with the remaining students having isolated areas of weak cognitive abilities interfaced with their strong areas. All students, except three, out of the combined two classes had low auditory memory scores.

Additionally, two more subsets (n=9) from the seventeen low performing students were intra-analyzed. These nine students' erratic scores qualified them as "outliers" and statistical comparisons were made both with and without the outliers to see the effect they had on the national standardized achievement tests.

The 4E1 class had 14 high academically achieving students with scattered low cognitive areas: three students had low visual perceptual memory and eleven had low auditory memory. Ten students

were low academically performing, low cognitive skill students, with five of these qualifying as "outliers".

The 4E2 class had 13 high achieving students, all with auditory memory weaknesses and five also had visual perceptual weaknesses. Seven were low performing students, all with severe visual and auditory memory deficiencies. Four of these seven students qualified as "outliers".

This report is to determine the effect these cognitive deficiencies had on the total class' achievement test scores as an aggregate group.

On the posttest immediately following the BTA/AL treatment, these two classrooms while above the norms, were below in achievement gain expectations. It is to be determined whether a classroom comprised of almost half of the students with low cognitive skills affects class composites and other critical achievement areas as reading, math, language, and science. An analysis was needed to determine when these low cognitive skill students made academic achievement gains.

This unforeseen profile of falling below the national norm expectations (NNE) created a necessity for inquiry because these two classrooms had followed the executive criteria 68%-54% and the teaching had been evaluated at the "Good Conditions Level" to policy adherence" (Erland, 1998). Since this researcher had seen latency effects in academic achievement improvement numerous times for students with low cognitive skills, the unanswered questions warranted further investigation.

Table 1, a standardized Norms table, compares the treatment and controls pretest to posttest Standard Score point Differences (DSSs) with the National Norms (NNE) Expectations. The Norms figure is the second number on the table under NN (National Norms). These NN expectation for gain figures vary within the same grades because the schools conducted the testing at opposite times, fall and spring.

The two fourth grade classes in School 2 fell below the National Norm Expectations posttest (See Table 1). However, when pooled with the strong 4E3-classroom, and compared to the National Norms, these three fourth grade classes trended some significant gains in the Composite, Reading Total, Vocabulary, Reading Comprehension, Math Total, Language Total, Core Total, and Spelling subtests at

the .01 and .05 levels. Math Concepts, Problem Solving, and Computation are most directly affected by misapplication.

Table 1 reveals tha the controls' solid gains beat the norms in all but one instance, the 5th grade control group in Social Science. The 8.26 score is below the comparative 5E1 Norm of 14. The eleven experimental classrooms had gains 79% greater than the norms (Erland, 1999d, 1998).

Table 2. shows the positioning of the two 4E1 and 4E2 classrooms with the other experimental classes and the two control groups. When pooled with the strong "star" 4E3 class, 4E1 had 10/13 primary academic subtests statistically significant, and 4E2 had 9/13 subtests significant showing important positive trending.

Table 1.

ITBS Academic Subject Comparisons of BTA

Pre- to Posttest Point Standard Score Differences (SSDs)

Compared to National Norm Expectations; BTA Gains 79% Greater than the National Norms

Eleven Experimental Groups with Two Control Groups

Class	Composite	Reading **Total**	Vocab	Read Compr	Math Total	Math Concepts	Math Prob	Math Computa	Lang Total	**Spell**	Core Total	Social Science	Science
	BTA - NN	BTA - NN	BTA - NN	BTA - NN	BTA - NN	BTA- NN	BTA - NN	BTA - NN	BTA - NN	BTA - NN	BTA - NN	BTA - NN	BTA - NN
4th E3	26.86 - 7	24.50 - 9	20.64 - 9	28.14 - 9	22.64 - 12	16.51 - 12	28.93 - 11	30.07 - 13	33.92 - 12	31.28 - 13	27.21 - 11	19.57 - 9	38.86 - 9
6th E3	23.84 - 4	15.00 - 7	13.10 - 7	17.84 - 7	21.78 - 10	23.26 - 10	20.68 - 8	46.47 - 11	25.57 - 8	18.36 - 8	21.05 - 8	31.31 - 7	32.47 - 7
5th E1	21.72 - 9	17.16 –13	**13.72-14**	20.48 - 13	23.04 - 14	18.72 - 14	27.48 - 15	33.12 - 15	35.64 - 14	23.04 - 15	25.28 - 14	18.28 - 14	16.60 - 14
6th E1	17.04 - 7	16.04 - 12	16.28 - 12	15.71 - 10	25.90 - 13	21.66 - 13	30.14 - 12	21.09 - 13	27.38 - 12	20.95 - 12	23.14 - 12	6.71 - 11	17.14 - 11
8th E3	14.42 - 3	11.64 - 6	7.71 - 6	15.87 - 7	11.07 - 7	13.64 - 9	9.14 - 6	16.28 - 9	17.78 - 6	22.78 - 8	13.50 - 7	12.35 - 7	19.07 - 11
4th E1	13.89- 11	10.62 - 14	10.92 - 15	9.83 -14	16.04 - 15	20.37 - 15	11.62 - 15	9.16 - 15	15.41 - 16	15.70 - 17	13.70 - 15	7.91 - 15	22.79 - 16
4th E2	13.50- 11	**13.85-14**	16.45- 15	11.15 - 14	11.75 - 15	12.95 - 15	10.50 - 15	**15.35 - 15**	19.20 - 16	20.50 - 17	**14.95- 15**	6.45 - 15	15.25 - 16
7th E2	15.10 - 6	14.73 - 12	19.00 - 11	8.63 - 10	11.84 - 11	12.57 - 11	**11.47- 11**	5.89 - 12	17.57-11	28.27 - 10	14.78 - 11	20.26 - 10	7.10 - 10
7th E1	13.60 - 6	17.13 - 12	19.40 - 11	14.93 - 10	10.40 - 11	12.00 - 11	8.80 - 11	17.80 - 12	13.20 - 11	15.40 - 10	13.46 - 11	16.73 - 10	12.40 - 10
5th E3	17.48 - 6	12.72 - 8	13.16 - 8	12.44 - 8	**13.60- 14**	15.64 - 11	11.28 - 10	16.00 - 13	16.96 - 10	19.04 - 10	14.52 - 10	22.84 - 8	25.04 - 7
7th E3	11.00 - 4	**7.64-7**	**7.68 - 7**	**7.80 - 8**	**7.76 - 8**	4.12 - 9	11.24 - 8	**10.28- 10**	9.17 - 8	15.76 - 7	**8.16 - 8**	10.36 - 7	14.36 - 7
6th Contrl	17.81	15.27	14.86	15.13	16.45	14.68	18.72	25.13	26.90	23.40	19.54	15.68	22.81
5th Contrl	19.30	19.03	19.69	19.03	23.65	23.23	23.80	23.42	28.38	21.92	23.69	8.26	25.76

The right figure in each cell is the norm, which was rounded up to a whole number for readability.

	BTA Pt. Differ Scores GREATER than the Norms
	BTA Pt. Differ Scores MATCHING the Norms
	BTA Pt. Differ Scores BELOW the Norms

Table 2. Subject and Classroom Comparisons

The degree by which the teachers followed the 19 Executive Criteria Measures – Four Success Levels – Ideal, Good, Fair, to Poor

Shaded areas = Classrooms are in horizontal rows with 90 academic subject gains matching or greater than the controls and norms, 65 academic subjects are statistically significant for the experimental groups / norms and controls

	Followed Executive **Criteria** 1/19 & Differentia Weights	**Composite**	**Read Total**	**Vocab**	**Read Compre.**	**Math Total**	**Math Concept**	**Math Prob Solv**	**Math Compu-tation**	**Lang Total**	**Spell**	**Core Total**	**Social Science**	**Science**
4th E3	**98%-98%**	** collectively	** →	**	**	* *	**	**	**	**	**	**	**	**
6th E3	**77%-73%**	**	**15.00 - 7**		**17.84 - 7**	† **Pooled**	**23.26 - 10**	**20.68 - 8**	**			**21.05 - 8**	**	**32.47 - 7**
5th E1	**70%-70%**	**21.72 - 9**			**20.48 - 13**	**23.04 - 14**		**27.48 - 15**	*	**35.64 - 14**	23.04-15	**25.28 - 14**	†	
4th E1	**63%-68%**	*		**Pooled** * ↔	**	*	**20.37 - 15**			**	**	**		**
4th E2	**54%-63%**	*	**	**Pooled** * ↔	**	*				**	**	**	**Pooled** ↔	**
8th E3	**50%-54%**	*			**15.87 - 7**				**16.28 - 9**	**	**	*	**12.35-7**	**19.07 - 11**
6th E1	**50%-53%**		**16.04 - 1**	**16.28 - 12**	**15.71 - 10**	*	**21.66 - 13**	†		**27.38 - 12**		**23.14 - 12**		
7th E2	**43%-50%**	*	**	Pooled ** ↔						*	**	Pooled ** ↔	**	
7th E1	**40%-43%**	**	Pooled ** ↔	**						*	**	Pooled ** ↔	**	
5th E3	**30%-36%**												*	**25.04 - 7**
7th E3	**25%-30%**	*	**Pooled** ** ↔	**						*	*	Pooled ** ↔	**	
6th Contrl		**17.81**	**15.27**	**14.86**	**15.13**	**16.45**	**14.68**	**18.72**	**25.13**	**26.90**	**23.40**	**19.54**	**15.68**	**22.81**
5th Contrl		**19.30**	**19.03**	**19.69**	**19.03**	**23.65**	**23.23**	**23.80**	**23.42**	**28.38**	**21.92**	**23.69**	**8.26**	**25.76**
# of Gains		**9- 8**	**8- 6**	**7 - 6**	**7 - 3**	**6 - 5**	**4 - 1**	**4 - 2**	**4 - 3**	**9- 7**	**8 - 7**	**10 - 7**	**8 - 7**	**6- 3**

Note: The academic subjects matching the controls show the pre- to post-test standard score point differences (DSSs), followed by the national norms expectations. The final tally row includes academic totals of subjects, which closely matched the controls followed by the number of academic subjects significant.

† Sig. p < .1 * Sig. p < .05 ** Sig. p < .01

One-Year Longitudinal Gains for 4E1 and 4E2.(Entering 6th grade)

Still pooled with the strong "star" 4E3 class from School 2, the classes were statistically significant at the < .01 level against the National Norms (NN) in all 13 primary ITBS academic achievement subtests, with the exception of 4E2 not being significant in the Math Computation subtest, and 4E1 being significant at the <.05 level in Math Computation (Erland 1999c, 1999d).

School 2's ITBS Building Averages Report revealed the combined classrooms one-year longitudinally were working at +1 1/2 years above grade level in Composite, Reading Comprehension, Reading Total, Math Problem Solving, Language Total, Core Total, and Social Science. They were two years above grade level in Science, and slightly above grade level in the remaining subtests.

These scores indicate maintenance with continued growth for the School 2's two fourth grade classes, as they had been working at, or slightly above, grade level for the previous three years.

Two-year Longitudinal Gains for 4E1 and 4E2 (Entering 7th grade)

Following the BTA/AL training, and unlike School 1's 4E3 class that remained as a yearly intact group, the 4E1 and 4E2 students were randomly assigned to 5th and 6th grade classrooms. Data was extrapolated from the subsequent classrooms into the original BTA/AL intervention student configurations of 4E1 and 4E2.

Additional Cognitive Skills Analyses of the WJ and the DTLA-2 (6 subtests).

The DTLA-2. Four subtests (two visual and two auditory) were given each student on the DTLA-2 pretest (administered in September) and posttest immediately following the initial fourth grade treatment (in early January the same instructional year). The following chart gives a comparison summary of the cognitive skill levels of the 4E1 and 4E2 classrooms.

An interclass comparison of cognitive skills was necessary to determine differences between groups. On the WJ Auditory and Visual Memory pretest, 4E1 and 4E2's scores ranged in the mid ranges of 55-58%, with the exception of 4E2's Auditory Memory score was at a lower 37%. Therefore, these three classrooms cognitive skills were somewhat comparable, as they all had auditory memory weaknesses with visual perceptual deficits.

Table 3. A Comparison of the DTLA-2 Pre- and Posttest Percentile Scores of the 4E1 & 4E2 Classes

DTLA-2 Subtest Percentiles	**4E1 (n=23)**		**4E2 (n=24)**	
	Pretest	**Posttest**	**Pretest**	**Posttest**
Visual Letters	**42 %**	**78 %**	**38 %**	**83 %**
Visual Closure	**54**	**70**	**51**	**73**
Auditory Memory for Words	**25**	**40**	**15**	**42**
Oral Directions	**69**	**89**	**62**	**91**

The ITBS-CogAT Two-Class Composite Profile

School 2 began the ITBS-CogAT the year of the study. The scores for 4E1 and 4E2 were Building Average composites for the two fourth grades. Therefore, the CogAt scores began in 1996, and could be tracked posttest (1997), one year longitudinally - 1998, and two years longitudinally - 1999. The following table shows the gains made these three separate batteries.

Table 4. Cognitive Skill Composite Percentile Scores on ITBS-CogAT for 4E1 and 4E2 Classes.

	Verbal Percentile	Quantitative Percentile	NonVerbal Percentile
1996 pretest n=53	65	58	59
1997 posttest n=51	67	71	72
1998 1-year longitudinal	70	66	72
1999 2-year longitudinal	69	70	76

Table 4. Revealed gains in the Quantitative and NonVerbal areas, with minimal gains in Verbal Batteries, The Quantitative Battery, with its growth at the posttest point, and then maintained, has high correlation with both mathematical learning in school and with reading comprehension (Riverside 2000 Technical Summary I994). Consideration should be made for the addition of new students each progressive year. These untreated students would affect the Composite scores.

Growth in the NonVerbal area will often progress ahead of the Verbal Battery for students with cognitive skill limitations (Riverside 2000, 1994; Weschler, 1989; Woodcock, 1978, Level of Processing Theory; Johnson & Myklebust, 1967, Information Processing Theory). These authors indicated that the visual and auditory perceptual levels must be in place for reading comprehension, mathematical-analytical logic and higher-order thinking to succeed.

Each student had their own CogAT summary on the ITBS. Each student from both fourth grade classes was analyzed into two divisions: higher and lower. The cut-off point was <50% and below on either Verbal, Quantitative, and NonVerbal Batteries, with a similarly low correlation score in either a reading or math subtest.

Intra-Analyses of Student ITBS-CogAT (Cognitive Skill) scores

Tables 5. and 6. revealed the cognitive skills measurements of the CogAT scores for each student in the 4E1 and 4E2 classes, and the composition of high cognitive students with low cognitive skill students.

Additionally, each student who was low on the CogAt, was then analyzed for academic achievement proficiency in Reading, Math, Language, and Science on the ITBS pretest (3rd grade). They performed at or just below grade level (NGE) on the pretest in one or more subject areas. This concurred with the CogAT findings (revealing least one of the three low cognitive areas), they were then cross-analyzed on the additional WJ and DTLA-2 cognitive skills tests for percentile scores that fell below < 50%. This analyses resulted in the two low achieving subsets (4E1, n=10 and 4E2, n=7) for the 4E1 and 4E2 classes. This totaled a subset of 17 low cognitive skill students for the two fourth grade classrooms with nine possible "Outliers".

Most of the students in the two classrooms had low auditory memory scores n=40/44. The 4E1 low subset of ten students had a range of two to five deficiencies on the six DTLA-2 and WJ subtests.

The 4E2 subset of seven students had a range of two to six deficiencies on the DTLA-2 and WJ subtests. All twenty students in the 4E2 class had auditory memory weaknesses. In the 4E1 classroom, 20/24 students had auditory memory weaknesses.

Student #18 qualified as an "outlier" due to his erratic and low achievement test scores. This student was on Ritalin for his diagnosed ADHD. Longitudinally, although he had some regression in Reading Comprehension, Science, and Math Total, and was almost at grade level in Language, 6.5 NGE. Entering seventh grade, he made progress in Math Problem-Solving, moving up to 5.5 NGE. Surprisingly, he performed above grade level at a high 10.5 NGE in Spelling.

Interestingly, of the students not classified in this lower subset, there were four of the high achieving students in the 4E2 class with four to five serious cognitive area deficiencies (on the WJ and DTLA-2 measures). Yet, they compensated with their stronger areas and correspondingly had high academic ITBS achievement and CogAt scores so they did not qualify for the lower subset.

To be noted, one student in 4E2 (#21) with severely low auditory (0% to 16%) and low visual memory for letters (9%) on the DTLA-2, this affected her Quantitative score on the CogAT. Yet, with her visual and visual-auditory integration scores high (89% and 75%), she could compensate her weaknesses in test taking, and was therefore placed in the 4E2 High Achieving Group.

In the 4E2 class, there were two students entered into the low subset although they had a pretest score above 50%: 4E2 Student #3 had 52% in NonVerbal and 50% in Verbal, yet had a low 12% in Quantitative. This student, with four low cognitive skill area deficiencies, had 11%, Moderate Deficit, on the WJ Visual Speed subtest, and 1%, Severe Deficit, on the WJ Auditory memory subtest, overriding his higher CogAT scores in the Verbal and NonVerbal areas.

Similarly, 4E2 Student #10 had one isolated higher pretest score of 52% on the CogAT's Verbal subtest. Since his remaining CogAt scores were extremely low, testing protocol is questioned, qualifying him as an "outlier" in the low performing subset. He also had five exceedingly low cognitive skill area weaknesses (ranging from 0% to 16% in all six tested areas).

Table 5. 4E2 CogAt Percentile Trending.

	Verbal				Quantitative				NonVerbal			
Name	**Pre**	**Post**	**1 Year**	**2 Year**	**Pre**	**Post**	**1 Year**	**2 Year**	**Pre**	**Post**	**1 Year**	**2 Year**
	1996	**1997**	**1998**	**1999**	**1996**	**1997**	**1998**	**1999**	**1996**	**1997**	**1998**	**1999**
High Group												
Student # 22	99	87	77	95	79	91	87	86	55	77	91	94
	94	73	91	92	62	79	73	81	52	91	79	86
# 15	99	81	moved	no test	96	69	no test	no test	62	79	no test	no test
# 7	87	75	73	86	79	57	75	71	91	73	57	95
# 1	99	98	57	99	99	99	98	99	99	57	99	79
# 17	93	97	91	91	91	69	97	89	83	91	69	86
# 2	77	92	92	94	84	87	87	73	60	92	92	83
# 13	75	60	69	75	71	83	60	79	45	69	83	77
# 5	57	62	71	73	40	87	62	77	65	71	87	87
# 21	60	62	83	67	33	55	62	71	65	83	55	75
# 11	69	92	69	92	91	92	92	88	92	69	92	79
# 14	40	92	65	95	91	77	92	83	79	65	77	50
# 4	3	81	92	77	69	79	81	67	45	92	79	84
n=13												
Low Group n=7												
# 3	50	38	87	moved	12	62	38	no test	52	87	62	no test
# 20	38	71	71	92	27	83	71	87	25	71	83	91
Outliers - 4												
# 9 (eliminated earlier before tables)	45	33	92	62	21	55	33	50	33	92	55	75
# 10	52	29	13	16	6	43	29	38	29	13	43	57
# 18	1	8	4	4	3	8	8	8	13	4	8	7
# 16	13	83	67	33	12	62	83	80	33	67	62	43
# 6	38	75	40	29	17	57	16	50	45	73	33	23

Table 6. 4E1 CogAT Percentile Trending. N=24, Longitudinal N=20

	Verbal				Quantitative				NonVerbal			
Name	**Pre**	**Post**	**1 Year**	**2 Year**	**Pre**	**Post**	**1 Year**	**2 Year**	**Pre**	**Post**	**1 Year**	**2 Year**
	1996	**1997**	**1998**	**1999**	**1996**	**1997**	**1998**	**1999**	**1996**	**1997**	**1998**	**1999**
High Group												
Student # 1	97	95	99	84	98	91	95	97	84	95	91	99
# 4	93	95	93	60	88	87	95	65	83	93	87	69
# 14	94	94	71	92	86	94	94	73	65	71	94	77
# 22	88	94	96	84	84	89	94	96	88	96	89	95
# 6	71	60	81	67	83	60	60	69	87	81	60	86
# 3	82	73	69	55	54	62	73	67	49	69	62	48
# 8	48	84	27	92	57	84	11	81	57	79	33	92
# 12	75	29	29	79	84	67	67	45	45	75	75	83
# 15	55	60	79	60	55	75	60	94	52	79	75	92
# 16	50	77	81	77	84	75	77	91	55	81	75	84
# 23	83	94	60	75	73	89	94	83	87	60	89	67
# 24	75	45	60	45	87	83	45	35	57	60	83	60
# 21	69	73	77	75	79	75	73	77	65	77	75	69
# 22	88	94	96	84	84	89	94	96	88	96	89	95
n=14												
Low Group n=10												
Student # 7	38	11	27	29	25	33	11	45	31	27	33	43
# 9	13	25	43	48	29	77	25	69	48	43	77	65
# 10	38	71	25	60	57	48	55	45	43	25	48	60
# 17	16	50	moved		48	29	moved		45	45	moved	
# 19	67	60	84	50	11	71	60	65	25	84	71	89
Outliers - 5												
# 2	43	9	95	21	4	40	9	52	31	95	40	73
# 13	92	17	60	21	3	60	17	48	69	60	60	77
# 18	4	13	45	13	17	17	27	13	16	13	27	17
# 20	84	14	55	23	12	38	14	31	33	55	38	52
# 25	7	8	45	27	5	77	8	65	13	45	77	33

Additional Intra-Analyses of Cognitive Skill Area Weaknesses of 4E1 & 4E2 **High** Achieving Students:

n=27, tested n=25

The students were classified high from low by the CogAT and ITBS academic achievement subtest scores (at least one pre-training subtest was below < 50% in both areas). (see Tables 5 & 6) Two 4E1 students were absent for the WJ and DTLA-2 cognitive skills assessments, making 22 students tested. (12 higher academically achieving students and 10 lower achieving subset students). Only one 4E1 higher achieving student did not have any cognitive deficiencies. The remaining eleven higher performing students had 1-3 cognitive deficiencies (see Table 7).

Since each of the four WJ subtests becomes a single cluster of two units, this creates just six subtest score areas, rather than a total of eight. I.e. the WJ two Spatial Relations and Number Matching subtests create the Visual Speed Cluster. The Auditory Memory for Sentences and Number Reversals subtests create the Auditory Memory Cluster. Each cluster is scored as one unit. (see summary chart below).

Table 7. 4E1 & 4E2 Classroom Table Showing Invasive Number of Specific Cognitive Area Weaknesses for High Achieving Students 4E1 n=12 (2 students not pre-tested), 4E2 n=13 students, sum=25.

# of Cognitive Area Weaknesses Per Student, Measured by the Six WJ and DTLA-2 Subtest Scores	Number of *Higher* Performing Students in 4E1 Having These Area Weaknesses n=12	Number of *Higher* Performing Students in 4E2 Having These Area Weaknesses n=13
0	1	0
1	3	3
2	7	3
3	1	3
4	0	2
5	0	2
6	0	0

Additional Intra-Analyses of Cognitive Skill Area Weaknesses of 4E1 & 4E2 **Low** Achieving Students: n=17

The lower set of ten 4E1 students, had one to five cognitive area deficiencies as measured by the DTLA-2 and WJ subtests. The two students with just one and two area deficiencies, had low auditory, which appeared to have affected their information processing speed and learning ability. The remaining eight had three to five area deficiencies and could not compensate, as their combined weaknesses became a severe learning deficiency. Therefore, they could not process information efficiently. The 4E2 class had both high and low achieving students with more cognitive area eaknesses (three additional students, sum=8, with 4-6 low cognitive areas) than did the 4E1 class (sum=5). Yet, 4E1 had more students who qualified for the low subset 10 vs. 7 (see Tables 5 & 6).

Table 8. The Number of Cognitive Area Weaknesses by Low Achieving Students, sum=17 .

# of Cognitive Area Weaknesses Per Student, Measured by the Six WJ and DTLA-2 Subtest Scores	Number of *Low* Performing Students in 4E1 Having Those Weaknesses, n=10	Number of *Low* Performing Students in 4E2 Having Those Weaknesses n=7
0	0	0
1	1	0
2	1	2
3	3	1
4	4	1
5	1	2
6	0	1

Erland's (1994, 1992, 1989a) previous public school assessments corroborates these findings. These earlier reports revealed that most children have at least one deficient information-processing avenue. An individual is either an auditory, visual, or tactile learner, but seldom do all modalities work together optimally (Gardner, 1998, Erland, 1989a, 1989b).

This study reveals that of the 4E1 and 4E2 classrooms, only one student out of the two combined classrooms, N=43/44, did not have a cognitive skill weakness on the eight WJ and DTLA-2 subtests. All

primary learning pathways were intact for 4E1 student #16, and she scored in a solid range of 63% to 75% on the DTLA-2 and WJ subtests and similarly on the CogAT.

It is to be noted that a more comprehensive WISC-R psychological battery would give a more in-depth profile for these students. School Psychologists often administer the WISC-R for Special Needs student referrals.

Table 4. Documented gains in the Quantitative and NonVerbal areas, with the greatest change in the latter. Tables 5. and 6. demonstrated the four-year pre- to posttest CogAt trending scores for the two fourth grade classrooms. The ITBS individual student CogAT scores are shown as percentiles as represented on each student summary sheet.

Two Year Longitudinal Academic Achievement Gain Intra Analyses of the 4E1 and 4E2 Classrooms

Further Inter-class and Intra-class analyses revealed large academic achievement gains. Academic achievement had been previously at, or slightly above grade level for the three pre-training, and post-intervention years (grades 3, 4, and 5), were above, grade level entering grade 6, but beginning grade 7, 4E2 scores were now much higher than the 4E1 class.

Two-year longitudinal DSS (standard score difference) comparisons between the 4E1 and 4E2 students show greater Standard Score growth by the 4E2 class, which eventually surpassed the DSS scores of both the 5th and 6th grade Control Groups (see Table 9. the shaded areas). Since the students were dispersed yearly, and did not remain as intact groups, and with the 4E2 class DSS scores greater than 4E1 DSS scores, gives credence that this score increase was due to the earlier BTA/AL intervention, and can not be attributed to chance of subsequent fifth and sixth grade teachers' conventional instruction.

Analyzing the 4E2 class independently in Reading Comprehension a class standard score of 262 compared to the 231 NNE equals +31 points above the norms. With +10 DSS points, this computes to +3 years growth above the one year norm expectations for 4E2 in Reading Comprehension and ahead of the 4E1 class by more than one half a year's growth.

4E2 scored above the 4E1 class in Science, with four years growth or three years above the National Norm Expectations (NNE), and Social Science, with +3 1/2 years above NNE.

Concurrently, as a two-class Building Average aggregate composite, performance was now +1 to +3 1/2 years above grade level in all sixteen ITBS subtests. These increases included: +1 1/2 to +2 years in Reading Comprehension, Core Total, and Math Total; + 2 1/2 years in Composite, Language Total, and Science; to +3 1/2 years in Social Science (See Table 9). Yet, the 4E2 class was a year ahead (roughly 10 to 11 DSS points) of 4E1. However, they were comparable in Spelling, Social Science, Math Computation, and Math Concepts.

On the 4E1 and 4E2 Building Averages Classroom Composite, the two classrooms were working at 9.6 NGE in Reading Comprehension, or +2 1/2 Years above grade level, when earlier they were performing just at grade level in grades 3 and 4. In fifth grade, one-year posttest, growth begins momentum. Reading Total was 5.8 NGE for Reading Total for both classrooms, and 5.9 NGE for Reading Comprehension, going beyond the required one-year growth. The added growth is now clearly visible at the one-year longitudinal point, maintaining at two-years longitudinally.

A similar picture evolves for the two-class composite on the Math Total achievement subtest. The DSS points are 13 for grade 6, and 11 points entering grade 7. Two years longitudinally, the 4E1 class Standard Score is 245 over the 232 NN expectation. This is an additional one years' growth. Yet, 4E2 stays ahead of the 4E1 class with a standard score of 253 over the 232 National Norm Expectation (NNE) of +21 points, or almost two years' growth beyond the NNE of one-year. This is a +3 years growth for 4E2 in Math Total.

Table 9. Four-year Inter-Class Standard Score Comparisons of 4E1 and 4E2 on the ITBS Subtests with National Norm Expectations

	Compos	Reading	Reading	Reading	Math		Math	Math	Language		
		Vocab.	Compreh.	Total	Concepts	Probs.	Total	Computa	Spelling	Capitalizato	Puctuation
3rd Gr. Pre 2-Class Composite	182	182	183	183	175	180	178	172	174	176	173
4E1 Class n=24											
4th Gr. Pre BTA/AL	199	199	203	201	190	199	194	188	189	201	194
5th Gr. Post BTA/AL n=24	213	210	213	212	210	211	210	198	205	208	210
6th Gr. 1-Yr. Post BTA/AL n=22	**230**	**220**	**237**	**229**	**222**	**230**	**226**	**219**	**222**	**239**	**245**
7th Gr. 2-Yr. Post BTA/AL n=22	**251**	**236**	**255**	**246**	**242**	**248**	**245**	**240**	**242**	**259**	**253**
4E2 Class n=20											
4th Gr. Pre BTA/AL	206	204	208	206	197	203	200	183	190	207	199
5th Gr. Post BTA/AL n=**20**	220	221	219	220	210	213	212	199	211	214	221
6th Gr. 1-Yr. Post BTA/AL n=15	**243**	**243**	**241**	**242**	**228**	**238**	**233**	**221**	**228**	**247**	**249**
7th Gr. 2-Yr. Post BTA n=15	**260**	**249**	**262**	**255**	**249**	**258**	**253**	**242**	**245**	**270**	**273**
Nat'l SS Fall Expecta											
3rd Gr. Pre BTA/AL	176	175	177	176	173	175	174	171	174	175	177
4th Gr. Pre BTA/AL	192	191	194	192	188	192	190	187	190	192	193
5th Gr. Post BTA/AL	208	206	208	207	203	207	205	203	206	209	209
6th Gr. 1-Yr. Post BTA/AL	**222**	**220**	**220**	**220**	**217**	**221**	**219**	**217**	**221**	**223**	**223**
7th Gr. 2-Yr. Post BTA/AL	**233**	**232**	**231**	**231**	**230**	**234**	**232**	**230**	**233**	**235**	**236**
8th Gr.Norm Expectations	**244**	**243**	**242**	**242**	**242**	**245**	**243**	**242**	**244**	**245**	**246**
CONTROL GROUPS: 5th & 6th Grade											
5th Controls, AMA =26											
5th Gr. Pre AMA	**217**	**213**	**216**	**214**	**212**	**213**	**212**	**205**	**207**	**210**	**210**
6th Gr. Post AMA	**237**	**232**	**235**	**234**	**235**	**239**	**237**	**229**	**229**	**244**	**246**
7th Gr. 1-Yr. Post AMA	**255**	**244**	**243**	**244**	**248**	**258**	**253**	**248**	**244**	**259**	**272**
8th Gr. 2-Yr. Post AMA	**270**	**256**	**269**	**262**	**269**	**270**	**270**	**261**	**256**	**273**	**283**
6th Controls, AMA **=22**											
6th Gr. Pre AMA	**238**	**233**	**235**	**234**	**234**	**235**	**235**	**221**	**218**	**241**	**248**
6th 6E1-BTA/AL n=23											
6th Gr. Pre BTA/AL	**244**	**235**	**248**	**242**	**235**	**239**	**237**	**224**	**229**	**245**	**245**

Table 9. Four-year Inter-Class Standard Score Comparisons of 4E1 and 4E2 on the ITBS Achievement Subtests with the National Norm Expectations (NNE).

cont'd - Table 9.					
	Usage / Express	**Lang Total**	**Core Total**	**Social Studies**	**Science**
3rd Gr. Pre 2-Class Composite	179	176	179	187	184
4E1 Class n=24					
4th Gr. Pre BTA	194	194	197	201	199
5th Gr. Post BTA n=24	215	210	210	209	222
6th Gr. 1-Yr. Post BTA	**243**	**237**	**231**	**228**	**228**
7th Gr. 2-Yr. Long.	**260**	**253**	**248**	**262**	**247**
4E2 Class n=20					
4th Gr. Pre BTA/AL	200	199	202	212	214
5th Gr. Post BTA/AL n=20	227	218	217	218	229
6th Gr. 1-Yr.Long. BTA n=15	**245**	**242**	**239**	**243**	**255**
7th Gr. 2-Yr. Long BTA n=15	**262**	**262**	**257**	**269**	**263**
Nat'l SS Fall Expecta					
3rd Gr. Pre BTA/AL	177	176	175	176	177
4th Gr. Pre BTA/AL	194	192	191	193	193
5th Gr. Post BTA/AL	209	208	207	209	209
6th Gr. 1-Yr. Pst BTA	**223**	**223**	**221**	**223**	**223**
7th Gr. 2-Yr. Pst BTA	**235**	**235**	**233**	**234**	**234**
8th Gr. Norms	**245**	**245**	**244**	**244**	**244**
5th Controls, AMA n=26					
5th Gr. Pre AMA	214	210	212	223	219
6th Gr. Post AMA	**238**	**239**	**237**	**229**	**245**
7th Gr. 1-Yr. Post AMA	**257**	**258**	**252**	**256**	**262**
8th Gr. 2-Yr. Post AMA	**272**	**271**	**268**	**275**	**275**
6th Controls, AMA n=22					
6th Gr. Pre AMA	**236**	**236**	**235**	**239**	**240**
6th 6E1-BTA/AL n=23					
6th Gr. Pre BTA/AL	**247**	**241**	**240**	**248**	**248**

With National Norm Expectations for 6th and 7th grades ranging from 7-11 points, it can be calculated how many academic years' growth each class obtained. Table 2 (One-to two-year Longitudinal table) documented a few of the Norm Expectations figures for each academic subject. i.e. Reading Total expectations for grades 6 and 7 are 12 points. Class 4E1 one-year longitudinally, had nine DSS points above expectation s (229 SS with 220 NN expectations), or slightly less than one years' gain.

However, Class 4E2 one-year longitudinally, in Reading Total had twenty-two DSS points above expectations (242 SS with 220 NN expectations) This calculates to +22 points above expectations in Reading Total, or almost a +2 year gain, and additional year beyond NN expectations. The following year, reaching 7th grade, 4E2's two-year longitudinal score for Reading Total gained an additional +13 points, or another one-year gain. The schools' Building Averages Composite related that the combined 4E1 and 4E2 classes were working at a National Grade Equivalent (NGE) of 8.8 in Reading Total, or almost two years above grade level.

Below is an Intra-Analysis Summary of Table 9's Standard Score and Estimated Gain Comparisons of 4E2's 2-Year longitudinal gain over 4E!, the fifth grade controls (1-Year longitudinal), and the National Norms in six primary ITBS subtests. All scores are 7th grade Standard Score Comparisons from Table 9. The National Norm Expectation (NNE) or each subtest for seventh grade is in parenthesis following each academic subject (fall to fall norms).

Table 10. The 4E2 ITBS Class Gains Compared to 4E1, and the National Norm Expectations.

Subtest	4E2 SS pt. gain over 4E1	Additional growth over 4E1	4E2 SS pts. gain over NN (National Norms)	Additional growth over NN Expectation of 1 year
Vocab. (11)	+13 pts.	+1.2 years	+17 pts.	+1 1/2 years
Reading Compre. (10)	+ 7 pts.	+ 7 mos.	+31 pts.	+ 3 years
Read Total (12)	+ 9 pts.	+ 7 mos.	+24 pts.	+ 2 years
Math Prob. Solving (11)	+10 pts.	+ 8 mos.	+24 pts	+ 2 years
Math Total (11)	+ 8 pts.	+ 9 mos.	+21 pts	+ 2 years
Science (10)	+16 pts.	+ 1 1/2 years	+29 pts.	+ 3 years
Social Science (10)	+ 9 pts.	+ 7 mos.	+35 pts.	+3 1/2 years
Spelling (10)	+ 3 pts	+ 3 mos.	+12 pts.	+ 1.2 years

Academic Achievement Intra-Analyses of Low Cognitive Skill Student Subsets (Sum: n=17)

Table 11. revealed six primary ITBS academic achievement subtest tracking and Intra Analysis for the two low achieving student subsets (sum: n=17) of the 4E1 and 4E2 classrooms. Subsequently, the following six primary subtests were tracked for achievement change, as to which students received gains, the extent of the change, causes for the change, at the point in time it occurred, and whether the change maintained. The following six academic ITBS achievement subtests were analyzed: Reading Comprehension, Math Total, Math Problem-Solving, Spelling, Language Arts, and Science.

Two primary subtests, Vocabulary and Reading Total were not selected since 4E! class did not follow policy and eliminated the Latin Roots lessons, peer modeling, and dramatization executive criteria. Therefore, the Vocabulary and Science subtests were affected, which in turn influenced the Reading Total score that is a summation of the Vocabulary and Reading Comprehension subtests.

Since yearly class standard scores (SS) were evaluated previously in Table 10, for inter-classroom analyses, National Percentiles (NPR) and National Grade Equivalents (NGE) were tabulated from each low achieving student's profile for Inter- and Intra-Student Analyses. Grade level jumps could be more easily determined. The key at the bottom of the chart demonstrates growth points beginning at seven months to mark positive change, to + 1 1/2 years or more jump as notable increased growth.

The shaded areas marked for each student for each of the six academic achievement subtests indicates at what point in time the growth spurt occurred. The summary/tally area shows a comparison between growth and loss. Longitudinal maintenance factors varied between the low students, the two classrooms, and within the different academic subtests.

Math Total, Math Problem-Solving, and Spelling held steady longitudinally, whereas Reading Comprehension and Language had student scores that waned, while others showed growth. Interestingly, Reading Comprehension had subsequent posttest stagnation and loss, but it was followed by strong consistent growth one-year longitudinally, then fluctuated between regression and marked growth. Although some students showed some slight regression following a growth spurt, all made gains, and 34% of the low cognitive skill students continued to move ahead.

Many of the low cognitive achieving students had erratic growth-loss patterns. This may suggest a difficulty with cognitive flexibility (Hessler, 1982 p. 128). Even with this instability, all students conclusively evidenced marked growth, although with varying levels of change, and at different time points (see Table 11).

For Math Total, 65% of the students improved on the posttest, and fewer (6%) showed this second longitudinal year regression pattern, and 55% evidenced increased growth. The Math Total subtest profile has steady improvement from posttest (65%) one-year (56%) to two-year longitudinal (61%).

Math Problem-Solving, which involves higher order thinking skills, had minimal regression, growth on the posttest (53%) with marked change for several posttest and one-year longitudinally, and several large growth spurts at the two-year longitudinal point (46%).

The 4E2 class had strong growth in Reading Comprehension, Spelling, Math Total, Language, and Science at the one-year longitudinal point. This class continues to make gain in Science and Spelling at the two-year longitudinal point, whereas the 4E1 class did not.

For the 4E1 class, the Science and Spelling subtest growth appeared on the posttest, and the largest jump for Reading Comprehension was at one-year longitudinal posttest (see Table 12).

Table 11. 4E2 and 4E1 Class Intra-Analyses Trending of Low Cognitive Skill Students on Six Academic Achievement Subtests

	Reading Comprehension				Math Total			
Name	**Pre-4th**	**Post-5th**	**1 Yr-6th**	**2 Yr-7th**	**Pre-4th**	**Post-5th**	**1 Yr-6th**	**2 Yr-7th**
	Oct-96	**Oct-97**	**Oct-98**	**Oct-99**	**1996**	**1997**	**1998**	**1999**
4thE2 – 7								
# 18	10 2.3	11 2.9=	**41 5.4>**	8 4.1-	19 2.9	3 2.6=	**21 4.3***	21 5.0=
#16	22 3.0	36 4.3*	67 7.7>	62 8.0=	10 2.6	20 3.7*	**43 5.7>**	33 5.8=
# 6	26 3.1	33 4.2*	**47 6.0>**	30 5.4-	25 3.2	12 3.2=	**24 4.6***	29 5.6*
# 3	34 3.5	39 4.5*	28 4.5=	moved	57 4.3	**73 6.4>**	61 6.8=	moved
# 9	14 2.6	18 3.4-	28 4.5*	**71 9.0>**	42 3.8	54 5.3*	33 5.1=	**70 8.7>**
#10	2 1.3	**23 3.6>**	**61 7.1>**	48 6.8-	4 2.1	25 3.8*	**59 6.8>**	42 6.5=
#20	94 6.6	75 7.1=	57 6.7=	**98 13.8>**	84 5.7	68 6.0=	**70 7.6***	**96 13.1>**
4thE1 - 10								
# 2	22 3.0	26 3.8=	**54 6.5>**	**85 11.2>**	3.0 2.8	30 4.2*	**74 7.8>**	58 7.7=
# 7	52 4.2	39 4.5=	**67 7.7>**	**79 10.0>**	42 3.8	**70 6.2>**	26 4.6-	57 7.6>
# 9	73 5.5	15 3.1-	**41 5.4>**	30 5.4=	59 4.4	27 4.1=	**63 7.0>**	**73 8.9>**
# 10	48 4.0	52 5.2*	**67 7.7>**	48 6.8-	59 4.4	23 3.8-	**36 5.3***	11 4.3=
# 17	77 5.8	**80 7.6>**	moved	moved	3 1.9	**33 4.3>**	moved	moved
# 25	39 3.6	4 2 .1-	**44 5.7>**	17 4.2-	21 3.0	33 4.3*	30 4.8=	**57 7.6>**
# 13	22 3.0	18 3.4=	**61 7.1>**	36 5.9-	30 3.3	25 3.8=	**75 7.9>**	40 6.4-
# 18	30 3.3	6 2.4-	**47 6.0>**	27 5.1-	8 2.5	14 3.3*	10 3.7=	**35 6.0>**
# 19	59 4.5	**88 8.6>**	87 9.8*	79 7.3-	37 3.6	**60 5.6>**	49 6.0=	63 8.1>
# 20	22 3.0	**57 5.6>**	47 6.0=	**55 7.6>**	25 3.2	30 4.2*	31 4.9=	**47 6.8>**
	n=17	n=17	n=16	n=15	n=17	n=17	n=16	n=15
Total 17		**POST**	**1 Year**	**2 Year**		**POST**	**1 Year**	**2 Year**
	=	**5, 28%**	**3, 18%**	**2, 13%**	=	**5, 29%**	**6, 38%**	**5, 33%**
	-	**4, 24%**	**0,**	**8, 53%**	-	**1, 06%**	**1, 06%**	**1, 06%**
	*	**4, 24%**	**2, 13%**	**0,**	*	**7, 41%**	**4, 25%**	**1, 06%**
	>	**4, 24%**	**11, 69%**	**5, 34%**	>	**4, 24%**	**5, 31%**	**8, 55%**

Key:

= **little change + 6 months, - 5 months**

- **6 months or more drop**

***** **7 months to one + years growth**

> **1 1/2 years + growth**

Shaded areas on table are when growth spurts occurred

Math Probs					Spelling			
Pre-4th	**Post-5th**	**1 Yr-6th**	**2 Yr-7th**	**Name**	**Pre-4th**	**Post-5th**	**1 Yr-6th**	**2 Yr-7th**
1996	**1997**	**1998**	**1999**		**1996**	**1997**	**1998**	**1999**
4E2 Low 7								
22 3.0	9 2.7=	15 3.7*	**29 5.5>**	#18	75 5.1	69 6.0*	49 6.1=	**83 10.5>**
9 2.2	**25 3.8***	29 4.8*	34 5.8*	16	52 4.0	51 5.2*	**67 7.3>**	64 8.2*
33 3.5	25 3.8=	15 3.7=	18 4.6*	6	9 2.4	8 2.9=	**59 6.6>**	3 3.3-
58 4.6	**67 6.1***	**73 8.1>**	moved	3	12 2.6	18 3.6*	**35 5.3>**	moved
3 4.3	**61 5.7***	51 6.2=	**68 9.1>**	9	45 3.8.	29 4.1=	**45 5.8>**	**68 8.6>**
3 1.5	**40 4.6>**	**82 9.3>**	29 5.5-	10	1 1.1	**29 4.1>**	5 3.1-	4 3.5=
95 7.8	61 5.7-	82 9.3>	**99 14.1>**	20	58 4.2	47 4.9*	**59 6.6>**	**83 10.5>**
4E1 Low 10								
27 3.2	21 3.5=	**77 8.7>**	51 7.3-	# 2	21 3.0	5 2.7=	12 3.8*	17 4.9*
43 3.8	**61 5.7>**	35 5.1=	46 6.7*	7	26 3.2	**91 8.4>**	18 4.3-	11 4.3=
49 4.1	40 4.6=	**66 6.6>**	**80 11.1>**	9	21 3.0	12 3.3=	**45 5.8>**	51 7.3*
49 4.1	30 4.1=	40 5.5*	6 3.3-	10	30 3.3	33 4.3*	**41 5.6***	37 6.2=
3 1.5	**30 4.1>**	moved	moved	17	30 3.3	12 3.3=	moved	moved
13 2.4	25 3.8*	24 4.5*	**55 7.6>**	25	6 2.2	**20 5.2>**	7 3.3-	20 5.2>
49 4.1	21 3.5-	**82 9.3>**	34 5.8-	13	30 3.3	6 2.8=	12 3.8*	17 4.9*
9 2.2	9 2.7=	15 3.7*	**34 5.8>**	18	35 3.4	**69 6.0>**	59 6.6=	80 6.6=
49 4.1	**67 6.1>**	46 5.8=	**60 8.1>**	19	39 3.6	**54 5.3>**	45 5.8=	40 6.5*
27 3.2	**40 4.6***	46 5.8*	46 6.7*	20	21 3.0	12 3.3=	14 4.0=	20 5.2*
n=17	n=17	n=16	n=15		n=17	n=17	n=16	n=15
	POST	**1 Year**	**2 Year**			**POST**	**1 Year**	**2 Year**
=	**6, 35%**	**4, 24%**	**0**		=	**7, 42%**	**4, 24%**	**4, 27%**
-	**2, 12%**	**0,**	**4, 27%**		-	**0,**	**3, 19%**	**1, 6%**
*	**5, 29%**	**6, 38%**	**4, 27%**		*	**5, 29%**	**3, 19%**	**6,40%**
>	**4, 24%**	**6, 38%**	**7, 46%**		>	**5, 29%**	**6, 38%**	**4, 27%**

Language				Science			
Pre-4th	**Post-5th**	**1 Yr-6th**	**2 Yr-7th**	**Pre-4th**	**Post-5th**	**1 Yr-6th**	**2 Yr-7th**
1996	**1997**	**1998**	**1999**	**1996**	**1997**	**1998**	**1999**
4E2 Low 7							
40 3.7	37 4.5=	19 4.2=	**43 6.5>**	37 3.6	15 3.1=	**26 4.6***	12 4.0-
52 4.3	59 5.7*	**70 8.1>**	49 7.0-	37 3.6	44 4.9*	**89 11.6>**	83 11.8=
29 3.3	19 3.5=	**42 5.6>**	23 4.8-	66 4.9	26 4.0-	**52 6.3>**	16 4.3-
30 3.3	31 4.2=	24 4.4=	moved	70 5.1	49 5.1=	31 4.9=	moved
no test	6 2.6	**14 8.4>**	27 5.3-	49 4.1	9 2.8-	**20 8.9>**	22 4.9-
19 2.8	25 3.8*	**46 5.9>**	17 4.4-	19 2.8	12 2.9=	**37 5.3>**	**47 6.8***
61 4.6	63 5.4=	**59 6.9***	**96 13.7>**	92 7.6	77 7.3=	15 3.8-	**69 9.0>**
4E1 Low 10							
22 3.0	18 3.4=	31 4.8*	**45 6.8>**	25 3.0	18 3.4=	**89 11.6>**	73 9.5-
22 3.0	**60 5.7>**	42 5.6=	26 5.2=	44 4.0	63 5.3*	15 3.8-	**55 7.5>**
48 4.2	27 4.0=	**54 6.5>**	**77 10.5>**	82 6.1	49 5.1-	37 5.3=	**61 8.3>**
40 3.7	39 4.5*	**74 8.5>**	56 7.7-	42 3.8	**58 5.6>**	**50 6.7***	47 6.8=
40 3.7	34 4.4=	moved	moved	31 3.3	**49 5.1>**	moved	moved
11 2.4	6 2.5=	**16 4.0***	**38 6.1>**	42 3.8	**58 5.6>**	52 6.3*	47 6.8=
26 3.2	21 3.6=	**4 5.6>**	31 5.5=	10 2.9	12 2.9=	**56 6.7>**	34 5.8-
9 2.3	**31 4.2>**	42 5.6*	**49 7.0***	37 3.6	4 2.2-	2 2.3=	22 4.9>
65 4.7	**70 6.5>**	66 7.6*	66 8.7*	25 3.0	**89 9.0>**	64 7.5-	61 8.3*
37 3.6	29 4.2=	34 5.2*	39 6.2*	14 2.5	**44 4.9>**	42 5.6*	**51 7.2>**
n=16	n=16	n=16	n=15	n=17	n=17	n=16	n=15
	POST	**1 Year**	**2 Year**		**POST**	**1 Year**	**2 Year**
=	**10, 62%**	**3, 19%**	**2, 14%**	**=**	**6, 35%**	**3, 19%**	**3, 21%**
-	**0,**	**0,**	**5, 33%**	**-**	**4, 24%**	**3, 19%**	**5, 33%**
*****	**3, 19%**	**6, 37%**	**3, 20%**	*****	**2, 12%**	**4, 24%**	**2, 13%**
>	**3, 19%**	**7, 44%**	**5, 33%**	**>**	**5, 29%**	**6. 38%**	**5, 33%**

Analyzing Defined Outliers

Additional Intra-Analyses was needed to determine what the effect the lowest of the defined 17 severe cognitive skills and achieving students had on the nationally standardized ITBS achievement tests. In the 4E2 classroom, one outlier had been determined earlier (#9) and eliminated due to erratic scores. An additional four "Outliers" were identified. Of the fifteen students that remained longitudinally, this left eleven of the Total Group.

In the 4E1 classroom, twenty-two students remained Two-years longitudinally. Identifying five "Outliers", this left seventeen in the remaining Total Group.

The Standard Scores of four ITBS subtests were analyzed with Repeated Measures against the National Norm Expectations (NNE). T-test scores were also computed on SPSS software for both the 4E1 and 4E2 classrooms to determine statistical significance. Four academic achievement charts compare the pretest, posttest, and two-year longitudinal trending and changes with and without the nine "Outliers". The four academic subjects analyzed were: Reading Comprehension, Math Total, Science, and Composite.

Removing the nine "Outliers", all four academic subjects were now statistically significant for 4E2 on the posttest. The 4E1 class was statistically significant on the posttest in Math Total, Science, and Composite, but not Reading Comprehension. Previously, including the "Outliers," these two classes had fallen below the National Norm Expectations (NNE).

On these four subtests, both 4E1 and 4E2 were statistically significant both with and without the "Outliers" one- and two-years longitudinally. The following four charts for Science, Math Total, Reading Comprehension, and Composite show the comparison of the Total Group with the National Norms, and minus the "Outliers." See the following Tables for the statistical significances.

The following Tables 12-15 consist of four ITBS academic achievement subtest charts comparing the growth changes of 4E1 and 4E2 classes with and without the "Outliers". It represents a Standard Score Paired Samples t-tests Statistics for Repeated Measures. The Mean Standard Scores for each Subtest are Compared with the Total Group and Minus the Outliers with the Norms. The pre- and posttest class numbers were: 4E1 = 24 students, 4E2=20 students, Total Group=44 students, Total Group Longitudinally=37 students; 4E1=22, 4E2=15). Representative charts follow the Tables.

Table 12. ITBS Science Summary Chart

NS = Not Significant, † Sig. p<.1 * Sig. p<.05 ** Sig. p<.01 ***Sig. p<.001

	Pre-1	Post -2	1 Yr. Long Post -3	2 Yr. Long Post -4
4E1 Class				
Norms	193	209	223	234
Total Group n=22	198 NS	220 NS	238**	247*
- 5 Outliers n=17	205 NS	230**	244*	253**
4E2 Class				
Norms	193	209	223	234
Total Group n=15	213*	225 NS	250*	263*
- 4 Outliers n=11	223***	240**	259**	278***

Table 13. ITBS Math Total Summary Chart

NS = Not Significant, † Sig. p<.1 * Sig. p<.05 ** Sig. p<.01 ***Sig. p<.001

	Pre-1	Post -2	1 Yr. Long Post -3	2 Yr. Long Post -4
4E1 Class				
Norms	190	205	219	232
Total Group n=22	195 NS	209 NS	229*	246*
- 5 Outliers n=17	201*	215*	233**	251**
4E2 Class				
Norms	190	205	219	232
Total Group n=15	196 NS	207 NS	232 †	253*
- 4 Outliers n=11	208*	217 †	240*	268***

Table 14. ITBS Reading Comprehension Summary Chart

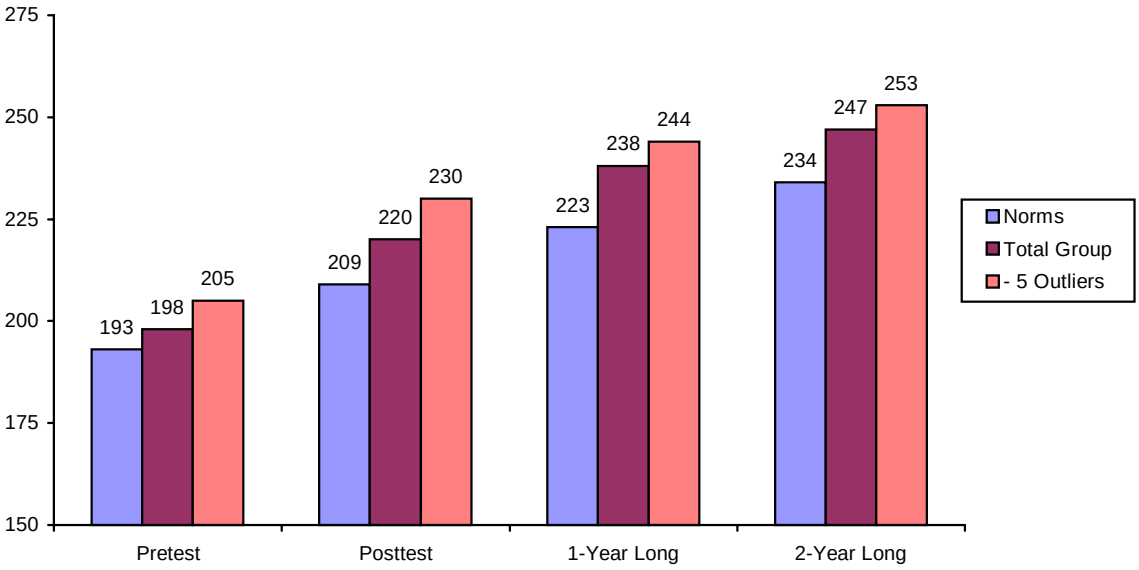
NS = Not Significant, † Sig. p<.1 * Sig. p<.05 ** Sig. p<.01 ***Sig. p<.001

	Pre-1	Post -2	1 Yr. Long Post -3	2 Yr. Long Post -4
4E1 Class				
Norms	194	208	220	231
Total Group n=22	200 NS	209 NS	239**	253*
- 5 Outliers n=17	207**	218 NS	245***	262***
4E2 Class				
Norms	194	208	220	231
Total Group n=15	204 NS	217 NS	242*	262**
- 4 Outliers n=11	217***	229***	249***	269***

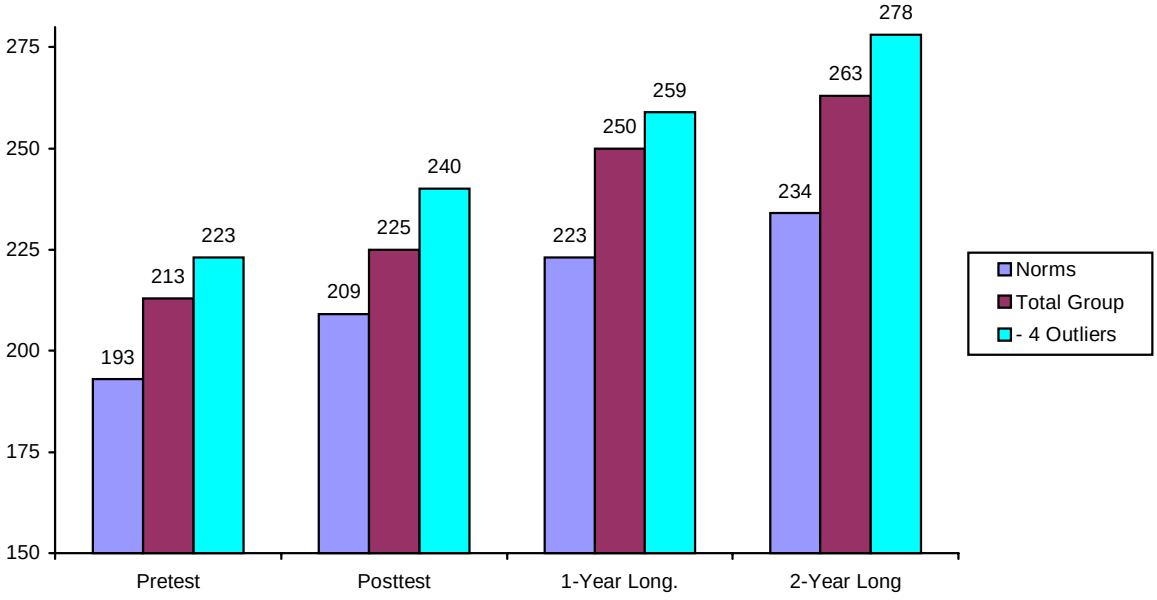
Table 15. ITBS Composite Summary Chart

NS = Not Significant, † Sig. p<.1 * Sig. p<.05 ** Sig. p<.01 ***Sig. p<.001

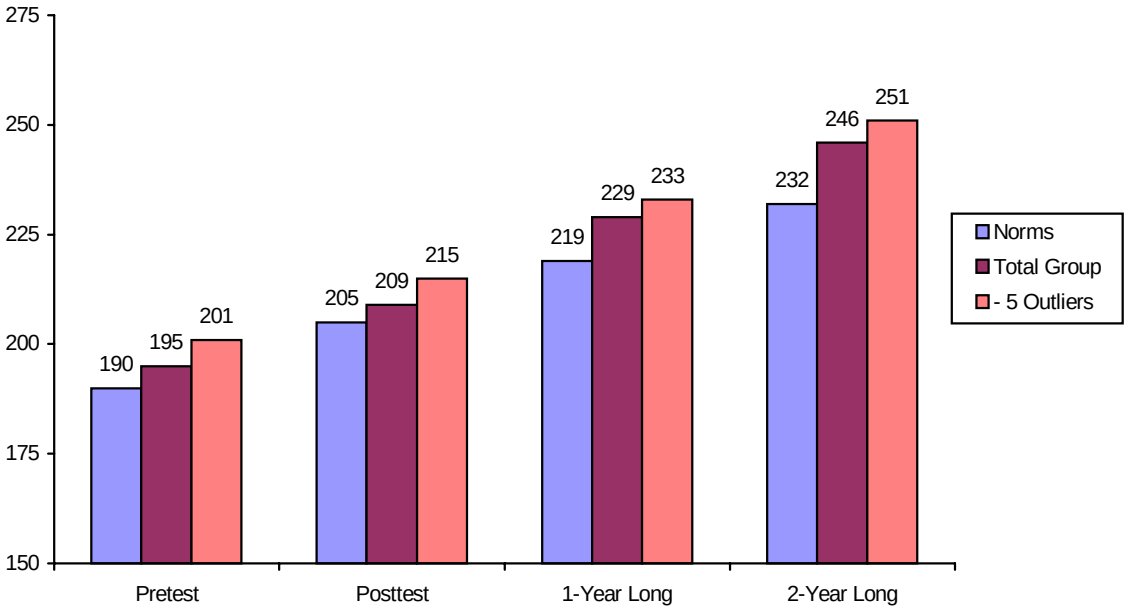
	Pre-1	Post -2	1 Y. Long Post -3	2 Yr. Long Post -4
4E1 Class				
Norms	192	208	222	233
Total Group n=22	198 NS	211 NS	234*	251**
- 5 Outliers n=17	206**	219*	241***	258***
4E2 Class				
Norms	192	208	222	233
Total Group n=15	204 †	217 NS	242**	260**
- 4 Outliers n=11	216**	230**	251***	277***



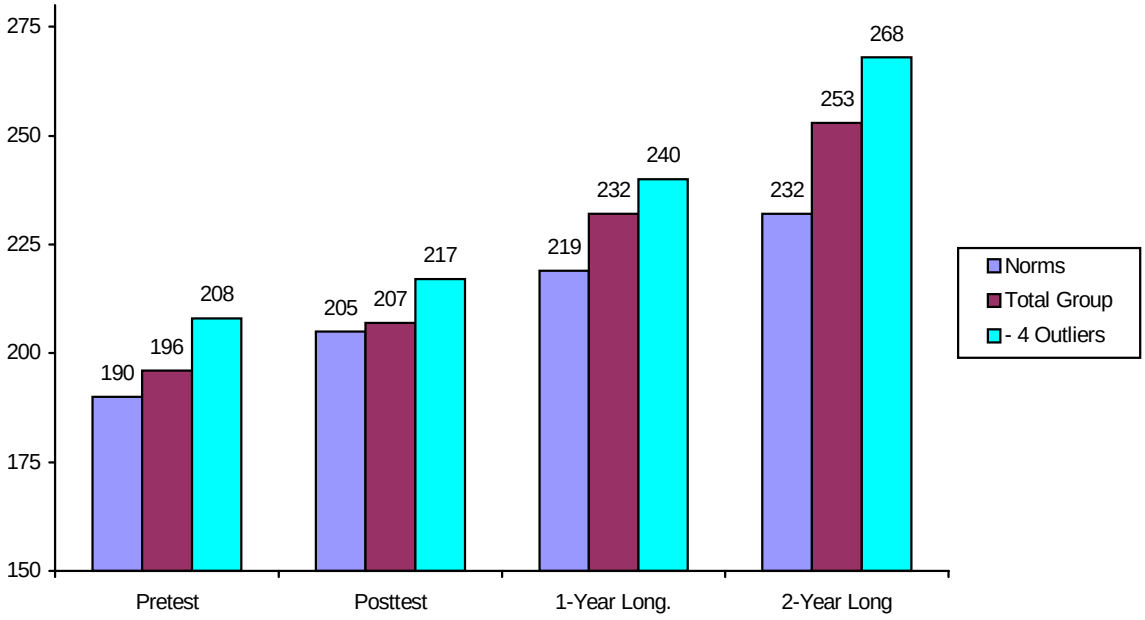
The 4E1 Classroom Science ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 5 Outliers. N Tot. Grp. = 22, Minus Outliers = 17



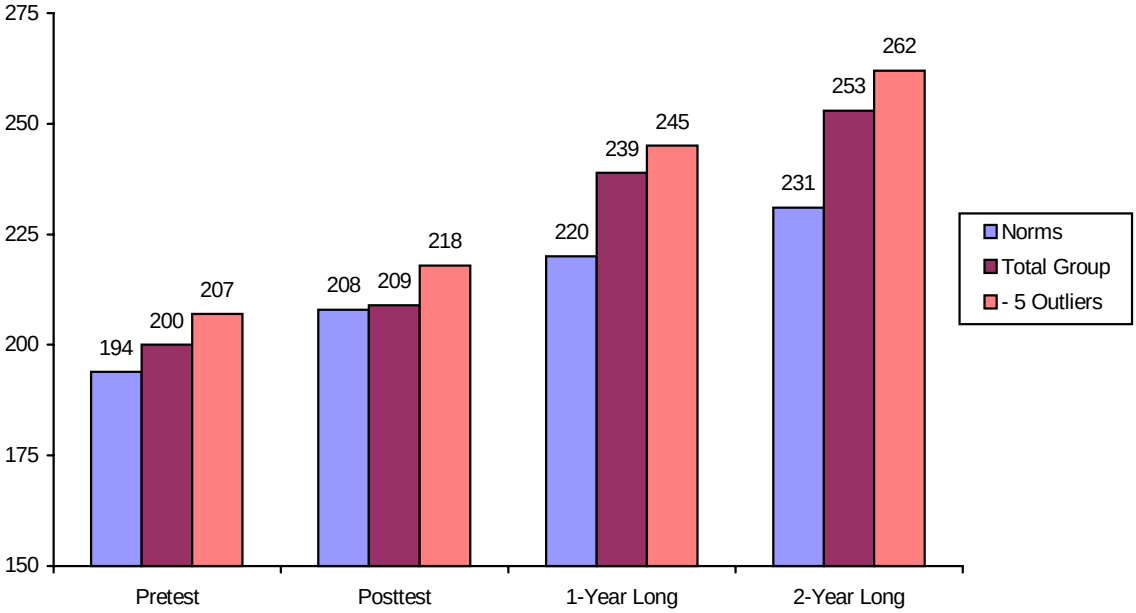
The 4E2 Classroom Science ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 4 Outliers. N Tot. Grp. = 15, Minus Outliers = 11



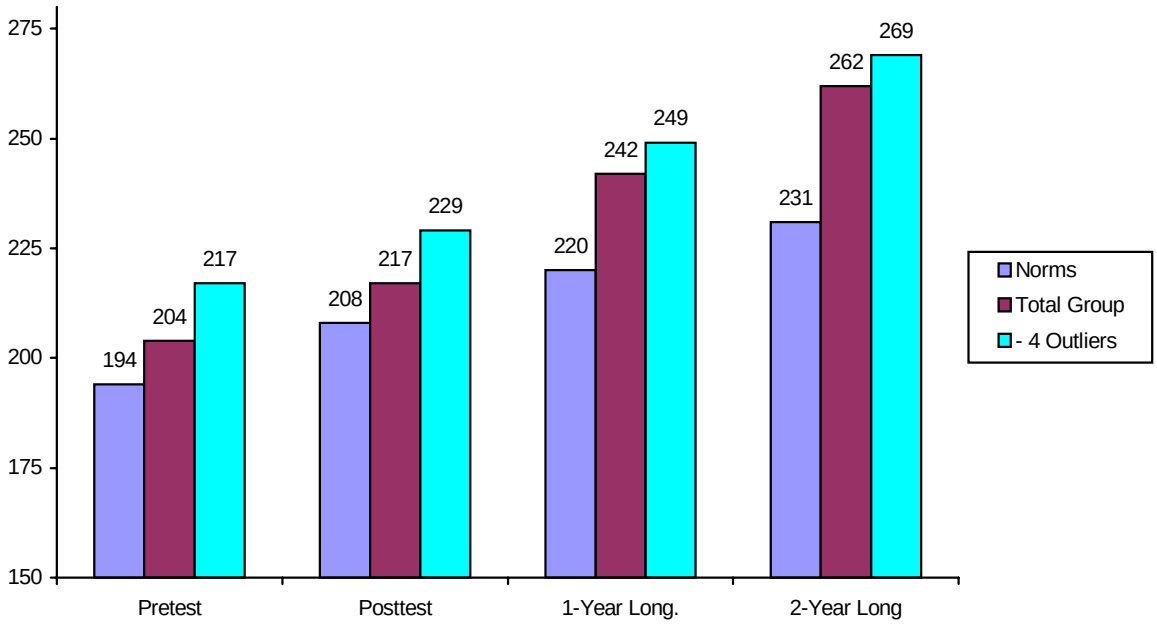
The 4E1 Classroom Math Total ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 5 Outliers. N Tot. Grp. = 22, Minus Outliers = 17



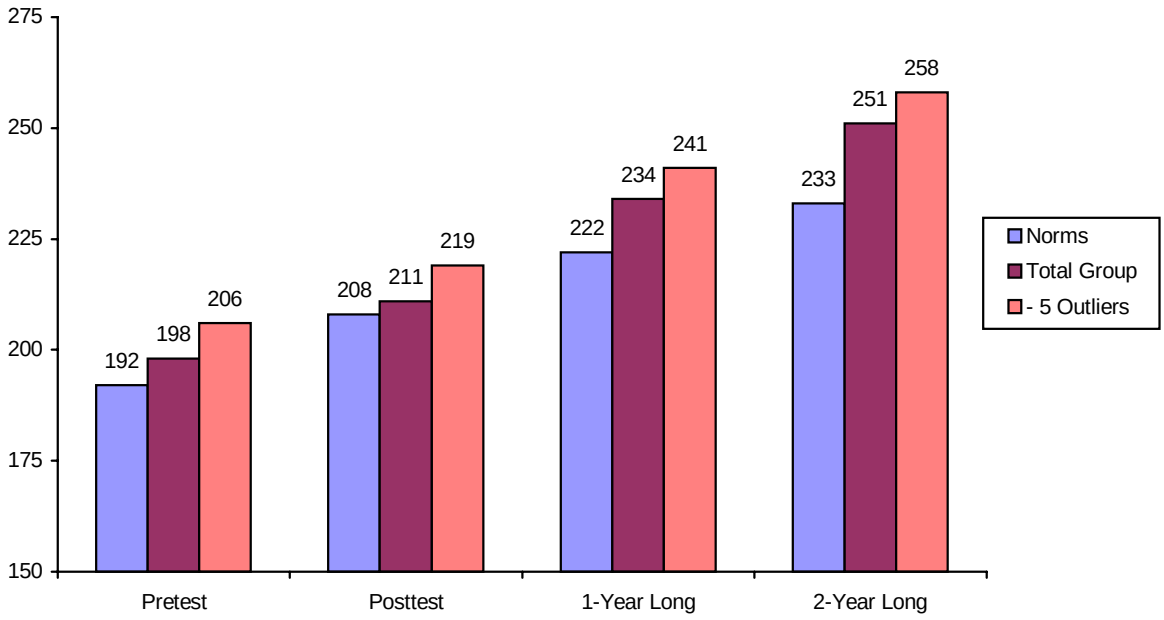
The 4E2 Classroom Math Total ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 4 Outliers. N Tot. Grp. = 15, Minus Outliers = 11



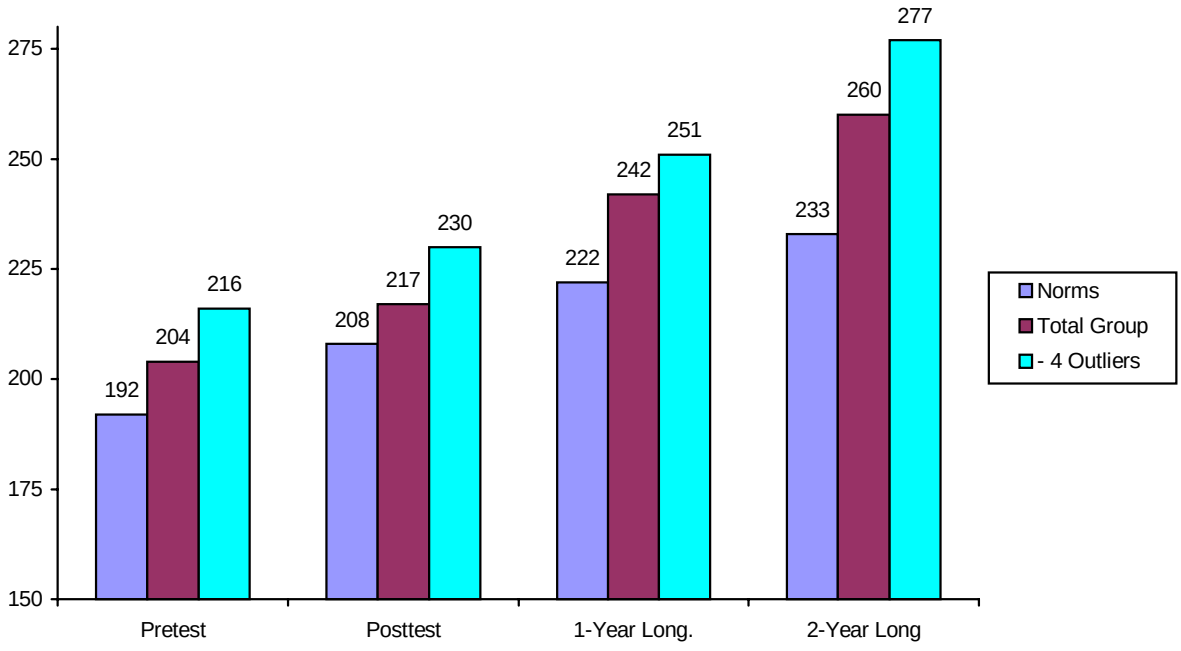
The 4E1 Classroom Reading Cpr ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 5 Outliers. N Tot. Grp. = 22, Minus Outliers = 17



The 4E2 Classroom Reading Cpr ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 4 Outliers. N Tot. Grp. = 15, Minus Outliers = 11



The 4E1 Classroom Composite ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 5 Outliers. N Tot. Grp. = 22, Minus Outliers = 17



The 4E2 Classroom Composite ITBS Subtest A Four-Year Comparison between the Norms, the Total Class Group, and Minus 4 Outliers. N Tot. Grp. = 15, Minus Outliers = 11

Discussion.

The analyses reported several major findings:

1) 98% of the students in two fourth grade classrooms (n=44) had varying cognitive skill deficiencies, which were primarily auditory, an important underlying requirement for conceptualization and high level learning (Meeker, 1991, Hessler, 1982, Reid & Hresko, 1981, Woodcock 1978). As psychologists recognize, each individual has his own psychological-cognitive profile and learning style. Cognitive skill class averages substantiated that 4/14 of the participating classrooms scored low in auditory memory as aggregate groups: 4E1 (25%), 4E2 (15%), 5th controls (39%-44%), and 7E2 (46%).

   Within the two fourth grade classrooms every student except one, had a breadth of invasive information processing area deficiencies which influenced the academic performance not only of each affected student, but the entire class as a whole. The 4E2 class had eight students with 4-6 cognitive area deficiencies; 4E1 had five students. Yet, 4E1 had more students qualifying in the low subset (10 vs. 7).

2) Low achieving students were factored out of each class into two subsets by their ITBS-CogAT and achievement test scores. Intra- analyses showed their academic achievement gains were latent; appearing 1-2 years subsequent the training.

3) Both high and low achieving students had cognitive skill deficiencies in varying degrees and area combinations.

4) High achieving students had 1-5 low cognitive areas, primarily auditory, except for one student, who ranged 63%-75% on the DTLA-2 and WJ.

5) Low achieving students had 2-6 severely deficit cognitive areas, both visual perceptual and auditory memory on the DTLA-2 and WJ. "Outliers" were identified, and their academic achievement test scores were independently analyzed from each of 4E1 (n=5) and 4E2 (n=4) classrooms. This analyses revealed that the "Outliers" sharply skewed the standardized academic achievement test scores. (see Tables 12-15).

6) The BTA/AL training had positive effect on both of these fourth grade classrooms who hovered near the norms for three consecutive years (grades 3, 4 & 5) and also fell below the National Norm Expectations (NNE) treatment posttest, grade 5. Yet, unexpectedly, they made large gains One- and Two-years longitudinally when reconfigured into their original class settings.

7) All students, high and low, even the "Outliers" improved their memory and cognitive abilities one- and two-years longitudinally post treatment. Therefore, the classrooms of mixed abilities and diverse learning styles changed to students with their auditory and visual learning styles operational, with fewer cognitive profile peaks and valleys.

8) Surprisingly, minus the "Outliers", 4E2 was now statistically significant on the posttest on four ITBS academic achievement subtests: Reading Comprehension, Math Total, Science, and Composite. 4E1 was statistically significant on the posttest in Math Total, Science, and Composite, but not Reading Comprehension.

9) All low achieving, severely deficit students (n=17) made subsequent cognitive skill and academic achievement gains on the ITBS-CogAT, some greater than others, and at different time points, in the six primary academic ITBS subtests intra-analyzed.

10) The most consistent change was in Reading Comprehension and the two Math subtests that appeared at the one-year longitudinal point. Marked gains were also evident in the ITBS Composite, Language, Science, and Social Science subtests for the two classes as an aggregate group (+1 1/2 to +3 1/2 years above grade level two years longitudinally).

11) The 4E2 class made higher standard score gains longitudinally than did the 4E1 class who had eliminated major elements of the executive criteria affecting the Vocabulary, Reading Total, and Science subtests.

12) The two 4E1 and 4E2 as aggregate classrooms evidenced large gains as Building Averages class composites, showing high impact, because ***all*** students made change longitudinally in their academic subjects, not just a few high achieving students as is most often the case.

Two-years longitudinally, 4E1 lagged behind the scores of 4E2 showing the necessity of following the BTA/AL executive criteria, and also indicating why the three ITBS subtests Vocabulary, Reading Total and Science were not significant. For Vocabulary, 4E2 had a +13 DSS pt gain or slightly more than +1 year additional gain. For Reading Total, 4E2 had a+9 pt. DSS gain over 4E1 or almost an additional years' gain. In Science, the 4E2 class showed +16 DSS points over 4E1, or +1 1/2 years' additional gain and +3 years over the National Norms.

The executive criteria was weighted and tabulated for the first of three reports (Erland, 1998, 1999c, 1999d). Each classroom was assigned a range of their policy adherence to the executive criteria. 4E1 scored slightly higher, because 4E2 had not taught a daily practice encoding-decoding lesson correctly, thereby eliminating its relevancy. This teacher had to leave the teacher training session early, creating an incomplete instructional knowledge base. Although this error was corrected at the four-week site visitation, the students had missed valuable initial encoding-decoding practice. Both classes had eliminated or shortened spatial orientation exercises that would have affected the Visual Closure scores, but 4E1 more than the 4E2 class.

Yet, in examining the One- and Two-year longitudinal scores, it became apparent that the 4E1 elimination of Accelerated Learning dramatization and rhythm, with the shortening or elimination of the Latin Roots practice, BTA/AL lesson items and rehearsal, had serious consequences.

Some classrooms may have more students with low cognitive skill deficiencies than others. Moreover, if many students are compensating with mixed cognitive skill weaknesses, all students should be assessed in the early elementary grades. Unfortunately, only master and doctorate professionals are qualified to give formal student assessments and evaluations. Testing hundreds of students can be

unrealistic, as further assessment and measurement is labor intensive and time consuming for the few master and doctoral level professionals available in each school building.

Currently, most schools have the resources to assess only the high or very low achieving to qualify for Special Services as Gifted, Speech Therapy, Behavior Disorders, Physically and Mentally Challenged, ADHD, and Learning Disabilities. If the main mid-section of classrooms trained cognitive skill deficiencies, with Accelerated Learning methodologies, according to this study's analyses of the ITBS and CogAT, higher academic achievement would ensue. By the time they reach secondary school, they would be ready to learn advanced curricula so necessary for our technological age.

Ideally, early identification of cognitive skill strengths and weaknesses would be beneficial. Most of the students in the study were ages of 9-14. Piaget (1950) reported brain growth spurts and integration cycles at ages 6-8, 10-12, and 14-16. According to Piaget, Concrete Reasoning ability begins at ages 10-12. Therefore, this study was initiated in grades four through eight, encompassing these critical brain growth stages of ages 9-14.

Additionally, it is important to realize that it may take more than one year for results to materialize for the low cognitive skill students. For years, this researcher (Erland, 1989b, 1994, 1998, 1999c) recognized the one- to two-year latency learning effect of improved cognitive skills to transfer to higher academic achievement for students with severe learning deficits.

This concurs with brain science findings that new neural pathways can be gradually strengthened and reformed through continuous mental exercise (Minsky, 1986). Additionally, information processing is improved through cognitive retraining. Subsequently, the encoding of pattern structure becomes possible through the improved learning modalities and senses (Meeker, 1991; Guilford, 1984, 1967).

Gardner (1998) quotes the work of psychologist D. Allen Allport in that "our cognitive activities are not related to the quantity of information to be processed, but rather, to the presence of particular patterns to which specific neural structures must (and do) resonate" (p. 281).

If it takes an additional one to two years for academic achievement to change for the low performing/cognitive level student, not only are two accelerated learning media applications appropriate, but essential. This could include summer refresher sessions, or after school classes. Additionally, this study shows that the importance of monitoring the Accelerated Learning application is paramount.

Therefore, it was recommended that the BTA/AL training be given in more than one application to especially benefit the low performing students. This study was initially set up with this purpose in mind, but the schools were not willing to spend two semesters on cognitive skill - faster information processing training when the schools already excelled in the state with high national ITBS scores. Unfortunately, many schools focus on their achieving students while other mid- and low- performing students "fall through the cracks" and may evidence accompanying behavior problems.

Concurrently, parents of low achieving students are often placated with "we are working on this, eventually you will see improvement, use Ritalin, or you will have to live with the problem." Then, the problem is passed on year to year, winding up in our high schools, colleges, and into the workplace.

With current pressures on schools and teachers to perform, it could be possible that good teachers may not receive the test scores they deserve, as the results would appear later for low achieving-cognitive skill students. Subsequent teachers would inherit the higher test scores with the accompanying merit pay. Additionally, with many classrooms having students with severely deficit cognitive skill areas, these low students skew the national academic achievement test scores, making it appear that the teacher lacked teaching skills.

With states adopting merit pay for teachers producing measurable test results, this report may prove to have significance. Therefore, yearly tracking of teacher's national achievement scores would be beneficial, plus noting how many severely low students each teacher has to teach.

Additionally, this study revealed that many students have processing weaknesses, some students can cope and learn better than others. With the proportion of learning disabled students rising over the past two decades, from 8 percent to 12 percent, (Cullen, 1999), learning disability qualification guidelines may require review.

Nonetheless, the major findings of this report warrant additional research to investigate student information processing levels in classrooms of various minority and economic distributions. More importantly, since low achieving students often become pigeonholed by their teachers and peers early on, they develop low self-esteem, then work and achieve according to self-fulfilling prophecy perceptions (Bandura,1986). Teachers and parents must have conviction that student learning change is possible, can happen, and that careful progress tracking, with positive encouragement, becomes paramount.

If both high and low achieving students benefit from accelerated learning on a media application, and there is strong longitudinal maintenance, more students should be assessed and trained with Accelerated Learning applications.

Conclusion.

If most students have cognitive skill and memory weaknesses, with diverse learning styles, Accelerated Learning combined with cognitive skill training using media has merit as a teaching tool. Although good teaching and classroom structure must accompany this type of instruction, according to the ITBS CogAT, increased classroom achievement test scores correlate with improved information processing skill and the ability to integrate complex information.

The current national focus on improved school administration, teacher performance quality with merit pay, and vouchers are important policy measures. Yet, training cognitive skill deficiencies to enhance all learning styles should be recognized as a solution to diverse learning problems that thereby can most probably increase academic achievement test scores. Unfortunately, this involves a paradigm shift as current popular Intelligence theories advocate teaching to the students' strengths or talents, and not correcting the underlying problem.

To contact the author: Jan Kuyper-Erland, jan@memspan.com, www.memspan.com 785-842-4636

References

Ayres, J. A. (1972). Sensory Integration and learning disorders. Los Angeles: Western Psychological Corporation.

Bandura, A. K. (1986*)* Social foundation of thought and action. A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. K. (1971). Social learning theory. Palo Alto, CA: Stanford University Press

Cullen, J. B. (June 1999). The impact of fiscal incentives on student disability rates. National Bureau of Economic Research.

Erland, J. K. (1989a). Retraining cognitive abilities: Memory and thinking improvement combining Suggestopedia with Cognitive Behavior Modification for ages 10-55. Journal of the Society for Accelerative Learning and Teaching, 14, (1), 3-42.

Erland, J. K. (1989b). Retraining cognitive abilities: A Longitudinal Study. Journal of The Society For Accelerative Learning And Teaching, 14, (2), 113-141.

Erland, J. K. (1989c). The Hierarchy of Thinking Model. Lawrence, KS: Mem-ExSpan, Inc.

Erland, J. K. (1989d). Achieving successful whole brain thinking. Journal of The Society For Accelerative Learning And Teaching, 14, (2), 173-179.

Erland, J. K. (1989e). Retraining thinking skill abilities. New Horizons for Learning.10, (1).

Erland, J. K. (1990, 1988, 1987, 1986, 1981). The Memory Retainer Mental Exercise Review Book. Lawrence, KS: Mem-ExSpan, Inc.

Erland, J . K. (1992). Reading and learning disabled students improve reading and math through video-taped analytical training. Journal of the Society for Accelerative Learning and Teaching, 17, (3 & 4), 171-223.

Erland, J. K. (1994, 1991). The Bridge To Achievement, Accelerated Cognitive Training System. Lawrence, KS: Mem-ExSpan, Inc.

Erland, J. K. (1994). Analytical skills training through video-tape instruction develops higher-order thinking skills capability. Journal of the Society for Accelerative Learning and Teaching, 19, (2), 155-227.

Erland, J . K. (1995). Cognitive skills training improves listening and visual memory for academic and career success. in ERIC Clearinghouse, Journal of Accelerative Learning and Teaching, 20, (1 & 2) 87-101.

Erland, J. K. (Fall 1998). Cognitive skills and accelerated learning memory training using interactive media improves academic performance in reading and math. Journal of Accelerative Learning and Teaching, 23, (3 & 4), 3-57.

Erland, J. K. (Winter 1999a). Building a more powerful brain. *Performance In Practice*. The American Society For Training and Development.

Erland, J. K. (1999b). High performance thinking counts. *Performance In Practice*. The American Society For Training and Development. and KC-ASTD's VISION, February, 1999.

Erland, J. K. (1999c). Brain-Based learning longitudinal study reveals solid academic achievement maintenance with Accelerated Learning practice. Journal of Accelerative Learning and Teaching, 24, (1 & 2).

Erland, J. K. (1999d). Brain-Based Accelerated Learning and cognitive skills training using Interactive media expedites high academic achievement. Journal of Accelerative Learning and Teaching, 24, (3 & 4).

Fairbanks, D. M. (1992). The Basics of Accelerated Learning. Alexandria, VA: The American Society for Training and Development.

Gardner, H. (1998, 1993). Frames of mind. New York: Basic Books.

Guilford, J. P. (1967). The nature of human intelligence. New York: McGraw Hill.

Guilford, J. P. (1984). An odyssey of the SOI model: An autobiography of Dr. J. P. Guilford. Tokyo: Japan Head Office International Society For Intelligence Education.

Guilford, J.P. (1986). Creative talents: Their nature, uses, and development. Buffalo, NY: Bearly Limited.

Hammill, D. D. (1998). Detroit Tests of learning Aptitude-4. Austin, TX: Pro-Ed.

Hammill, D. D. (1985). Detroit Tests of learning Aptitude-2. Austin, TX: Pro-Ed.

Hessler, G. L. (1982). Use and interpretation of the Woodcock-Johnson psycho-educational battery. Higham, MA: Teaching Resources.

Hieronymus, A. N. & Lindquist, E. F. (1990, 1974). Iowa Tests of Basic Skills: Manual for administrators, supervisors, and counselors. Boston: Houghton Mifflin Co.

Lozanov, F. (1978; 1971). Suggestology and the outlines of Suggestopedy. New York: Gordon & Breach.

Meeker, M. N. (1991; 1969).The structure of intellect: Interpretation and uses. Columbus, OH: Charles E. Merrill.

Meeker, M. N. (1999).The Structure of Intellect Systems: Teacher Training. Vida, OR: Structure of Intellect.

Minsky, M. (1986). The society of mind. New York: Simon and Schuster.

Piaget, J. (1950). The psychology of intelligence. New York: Harcourt Brace.

Reid, D. K., & Hresko, W. P. (1981). A cognitive approach to learning disabilities. New York: McGraw Hill.

Riverside 2000. (1994). Iowa Tests of Basic Skills Integrated Assessment Program, Technical Summary I. Chicago, IL: The Riverside Publishing Co.

Schuster, D. H. & Gritton, C. E. (1986). Suggestive accelerative learning techniques. New York: Gordon & Breach Science Publishers.

Sternberg, R. J. (1985). Human abilities: An information processing approach. New York: W. H. Freeman.

Sternberg, R. J. (1988). The psychology of human thought. Cambridge, MA: Yale University Press.

Sternberg, R. J. (1991). Competence considered. Cambridge, MA: Yale University Press.

Wechsler, D. (1989, 1974). Manual for the Wechsler Intelligence Scale for Children -Revised. New York: Psychological Corporation.

Woodcock, R. W. (1978). Development and standardization of the Woodcock-Johnson psycho-educational battery. Higham, MA: Teaching Resources Corp.

Woodcock, R. W. & Johnson, M. B. (1977,1978). Woodcock-Johnson psycho-educational battery. Boston: Teaching Resources Corp.

Woodcock, R. W. & Johnson, M. B. (1989). Tests of Cognitive Ability: Standard and Supplemental Batteries Examiner's Manual. (Rev. ed.). Allen, TX: DLM Teaching Resources Corp.