

REACHING DEEP IN MATH (DEVELOPING EDUCATIONAL EXCELLENCE AND PROFICIENCY IN MATHEMATICS)

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Abstract

This paper describes the DEEP in Math Program developed in the academic year 1998-1999 from a collaborative effort of the Louisiana Systemic Initiative Program (LaSIP) and the Louisiana Department of Education (LDE). It includes evidence of impressive results in low achieving schools and in high-poverty districts targeted by the effort. The plan was for LaSIP to give intensive content and leadership training in Summer 1999 and academic year 1999-2000 to carefully selected, well-qualified math leaders. These leaders were then employed full-time in the 1999-2000 academic year and beyond by their local education authorities to work with all math teachers in a few designated schools at some cohesive subset of grades 3-8.

Background

During the 1998-99 academic year, Dr. Billy Crawford, an Assistant Superintendent in the Louisiana Department of Education, organized a taskforce to study how mathematics achievement could be improved. The taskforce, which included representatives of the Louisiana Systemic Initiatives Program (LaSIP), reflected the increasing move toward high-stakes school accountability, with a focus on student accountability in English language arts (ELA) and mathematics. Its specific task was to study ways in which student mathematics performance in Louisiana could be improved substantially. At the time the task force made its recommendations, state testing in Louisiana was going through significant changes with the new LEAP 21 (Louisiana Educational Assessment Program) ELA and mathematics tests due to be instituted in Spring 1999. These tests, designed to be consistent with the National Assessment of Educational Progress (NAEP), were to provide baseline accountability data. LEAP 21 tests would be used at grades four and eight, and the Iowa Tests of Basic Skills (ITBS) would be used in grades three, five, six, and seven. Dr. Crawford's taskforce designed the DEEP in Math Program to select carefully chosen, mathematics-knowledgeable teachers for training as DEEP mathematics leaders in Summer 1999. Each leader was to be employed full-time by his/her district to work with all mathematics teachers in a few schools at a band of cohesive grade levels in grades three, four, five, six, seven, or eight. It was expected that the leaders would spend most of their time in the

classrooms of the targeted teachers. LaSIP, using NSF funds, was responsible for organizing and supporting the summer and follow-up academic year subject matter and leadership training for those mathematics leaders.

Program Description

The DEEP in Math Program features a coordinated K-8 curriculum with broad goals across all grade levels including specific student goals and pedagogical goals. Within each of the K-8 grade levels, specific mathematics content and skills are identified in each of the strands: numbers and operations, measurement, geometry, proportional reasoning and algebra, and data and chance. The total curriculum is displayed in poster format on the LDE website [1]. These goals can be accomplished only by constant reinforcement throughout the K-12 curriculum. They should be addressed in every classroom activity, homework assignment, and test.

Goals for Students:

- 1) Students will develop and use number sense, and estimation, while selecting efficient means of computation (mental math, calculators, paper and pencil), and judging reasonableness of answers.
- 2) Students will develop and use critical thinking, logical reasoning, pattern recognition, and a variety of problem-solving strategies.
- 3) Students will learn the meaning of important words and symbols relevant to the material being studied. They will understand written questions and explanations which include mathematical concepts and language. They will be able to explain mathematical ideas, relationships, and processes—orally and in writing.
- 4) Students will recognize connections among various strands of mathematics, and between mathematics and other disciplines. They will see the relevance of mathematics to real life.
- 5) Students will develop an appreciation of the power and the beauty of mathematics.

Pedagogical Goals:

- 1) Numbers will be kept *in context*—skill practice with isolated numbers, expressions, or equations will **not** be the primary focus of any lesson, assignment, or assessment.
- 2) Emphasis will be on developing intuitive, easy ways to solve problems. Computational skills, mathematical terms, and symbols will be learned *when they are needed* in developing important concepts or relationships, or in solving problems.

- 3) Abstract ideas, relationships, and processes will be studied as an extension of appropriate concrete, verbal, and numerical experiences.
- 4) Connections will be emphasized among various strands of mathematics, and between mathematics and other disciplines.
- 5) A variety of instructional strategies will be used, including whole-class instruction, small-group activities, and individual explorations.
- 6) Appropriate use of calculators and computers for learning and doing mathematics will be encouraged.
- 7) Assessment will be consistent with all of these goals, and will be considered an integral part of the teaching and learning process, as well as a means for assigning grades.

Implementation

The prospective DEEP in Math leaders were generally secondary-certified mathematics teachers who had already participated in one or more LaSIP professional development projects. In Summer 1999, they were offered two weeks of concentrated, concept-rich professional development, as well as leadership training coordinated across grades K-8 and emphasized numbers, operations, and number sense. Ms. Patricia Jones, now retired from the University of Louisiana at Lafayette (ULL), was an author of the 1991 Mathematical Association of America publication, *A Call for Change*, and had been centrally involved in ULL's professional development and pre-service math programs [2]. Ms. Jones, the key presenter for the 1999-2000 DEEP leadership program, placed heavy emphasis on elementary and middle school problem-solving techniques and their implications for conceptual understanding. The two-week summer workshops for DEEP leaders were supplemented with two weeks of academic year follow-up focusing on broader mathematics and on leadership. Thirteen parish systems employed seventeen DEEP leaders during the 1999-2000 academic year. One leader moved out of state in Summer 2000 and was replaced for 2000-2001 by another DEEP-trained leader. Another took a LDE regional job and was replaced by her mother, also trained as a DEEP leader in summer 2000. Since DEEP in Math leaders were employees of the parish school systems, LaSIP had no clear sustaining authority over them. By Fall 2001, several leaders had assumed additional duties in their parish systems, in some cases becoming mathematics supervisors and/or working with teachers from other schools in the system.

Results

For reporting student performance in Louisiana, the legislatively mandated NAEP-like LEAP 21 tests incorporated an extra, relatively narrow "Approaching Basic" category between the "Unsatisfactory" and "Basic" categories used in NAEP. Louisiana has announced the intention to phase out "Approaching Basic" in 2004. LaSIP endorses the temporary use of this extra category while the state adapts to new accountability regulations. Thus, the analysis we present here is divided into two forms: the percentages of students scoring "Basic or Above," and those scoring "Unsatisfactory." The "Approaching Basic" category is not considered in this discussion. LaSIP made a comparison of Spring 1999 and Spring 2000 LEAP 21 mathematics test results in all the lowest performing schools (i.e., those with 1999 School Performance Scores [SPS] below sixty) that were targeted by DEEP leaders. These included about 25% of all 1999-2000 targeted schools. An SPS of seventy was the (rough) average school score. The 1999-2000 comparisons showed that half of the low performing schools at each of the two grade levels (four and eight) had made substantial improvements, with smaller improvements at all but one of the other schools.

Table 1 and Table 2 give the two-year, 1999-2001 improvements in LEAP 21 mathematics scores for all 1999-2000 DEEP-targeted schools at the fourth grade or eighth grade level having 1999 School Performance Scores below sixty. There were eight schools of fourth grade and ten schools of eighth grade, with one school encompassing both levels. The seventeen schools in this study averaged about 125 students at the appropriate grade level, with a minimum number of about fifty and a maximum number just over two hundred. For each school, the percentage of students on Free/Reduced Lunch and the percentage classified as minority are based on 1999 LDE website figures. These figures generally show high poverty levels and high minority student population in the targeted schools. The LEAP math results at fourth and eighth grades for the first two years of the program generally showed strong student improvement at both grade levels. At the eighth grade level, the ten schools averaged close to the Spring 2001 state averages in both the "Basic or Above" and the "Unsatisfactory" categories, after being well below state levels in Spring 1999. The evidence shows that the DEEP in Math Program really worked for these 1999 low performing schools.

Results for Special Studies

A study of eighth grade LEAP 21 mathematics scores deals with those twelve parishes identified in the November, 2000 U.S. Census Bureau estimates as each having more than 25% of

its population classified as people in poverty. The twelve parishes are: Avoyelles*, Madison, Catahoula*, Orleans, Claiborne, Red River, East Carroll, Richland*, Evangeline*, St. Landry*, Franklin, and Tensas.

Table 1
Fourth Grade LEAP 21 Math Scores In All 1999-2001 DEEP Targeted Schools with 1999 SPS Below Sixty (1999 and Spring 2001)

	Parish	Students Scoring "Basic or Above"			Students Scoring "Unsatisfactory"			1999 Data	
		Spring 1999	Spring 2001	Percentage Increase	Spring 1999	Spring 2001	Percentage Decrease	% F/R Lunch	% Minority
Borgnemouth Elementary ¹	St. Bernard	9%	38%	29%	71%	34%	37%	93.8%	72.3%
Breaux Bridge Elementary	St. Martin	23%	41%	18%	53%	26%	27%	85.8%	70.5%
Dorseyville Elementary	Iberville	25%	48%	23%	45%	20%	25%	89.8%	92.9%
Julia B. Maitland Elementary	St. Mary	27%	59%	32%	50%	18%	32%	77.0%	56.3%
Mansfield Elementary 3-5	DeSoto	17%	26%	9%	65%	45%	20%	83.7%	81.2%
North Iberville Elem./High	Iberville	34%	57%	23%	45%	14%	31%	82.8%	87.3%
St. Martinville Elementary	St. Martin	14%	24%	10%	68%	42%	26%	85.6%	69.8%
James Stephens Elementary	Evangeline	12%	29%	17%	69%	28%	41%	94.8%	78.0%
8 School Average		20.1%	40.2%	20.1%	58.3%	28.4%	29.9%	85%	75%
Louisiana		41%	54%	13%	35%	23%	12%	59%	50%

The overall statewide 1999 data are for percentages of public school students at all levels. Of the 50% minority, all but 3% are African-American. ¹Borgnemouth Elementary School has been renamed "Smith Elementary."

Spring 2001 LEAP 21 eighth grade math test results showed that statewide, 46% of test takers scored in basic, proficient, or advanced categories. Five of the twelve high-poverty parishes cited (each marked above by an "**") had LEAP 21 math percentages scoring "basic or above" and ranging from 47% to 61%. Four of these five parish systems had employed a LaSIP DEEP in

Math leader working full-time with all eighth grade math teachers in one or more schools in these parishes. The fifth district had longtime LaSIP math and science involvement. This is a great testimonial to the early effectiveness of the LaSIP DEEP in Math Program. The five LaSIP-targeted parish systems cited above averaged over 52% scoring "Basic or Above," whereas the other seven parish systems averaged less than 28% scoring "Basic or Above," with none having more than 40% scoring at those levels. For the five high-scoring parishes, the average Census Bureau estimates of children under eighteen in poverty was more than one-third.

Table 2
Eighth Grade LEAP 21 Math Scores In All 1999-2001 DEEP Targeted Schools with 1999 SPS Below Sixty (1999 and Spring 2001)

		Students Scoring "Basic or Above"			Students Scoring "Unsatisfactory"			1999 Data	
		Spring 1999	Spring 2001	Percentage Increase	Spring 1999	Spring 2001	Percentage Decrease	% F/R Lunch	% Minority
	Parish								
P.G.T. Beauregard MS	St Bernard	24%	58%	34%	46%	21%	25%	76.8%	38.5%
Bunkie Middle	Avoyelles	25%	47%	22%	50%	35%	15%	86.9%	53.2%
East Junior High	St Landry	12%	21%	9%	66%	50%	16%	91.2%	98.4%
Mansura Middle	Avoyelles	28%	47%	19%	45%	30%	15%	76.4%	44.6%
Mansfield Middle 6-8	DeSoto	35%	40%	5%	42%	37%	5%	73.9%	75.7%
Marksville Middle	Avoyelles	40%	69%	29%	36%	11%	25%	84.0%	34.6%
North Iberville Elem./High	Iberville	13%	36%	23%	65%	40%	25%	82.8%	87.3%
Springville Jr. High	Red River	8%	32%	14%	54%	34%	20%	94.0%	83.0%
Ville Platte High	Evangeline	14%	55%	41%	60%	22%	38%	76.3%	65.4%
White Castle High	Iberville	20%	25%	5%	57%	50%	7%	78.0%	92.4%
10 School Average		22.9%	43.0%	20.1%	52.1%	33.0%	19.1%	80%	70%
Louisiana		39%	46%	7%	40%	31%	9%	59%	50%

The overall statewide 1999 data are for percentages of public school students at all levels. Of the 50% minority, all but 3% are African-American.

References

- [1] Louisiana Department of Education website, Internet: www.louisianaschools.net
- [2] J.R.C. Leitzel (ed.), *A Call for Change: Recommendations for the Mathematical Preparation of Teachers of Mathematics*, Mathematical Association of America, Washington, DC, 1991.