

**GREENWICH PUBLIC SCHOOLS  
MONITORING REPORT  
STUDENT ACHIEVEMENT: SCIENCE (E-003)  
SEPTEMBER 2007**

I hereby present my monitoring report on the District Ends Policy "Student Achievement." I certify compliance and that the information contained in this report is accurate.

Signed: \_\_\_\_\_  
(Betty J. Sternberg, Superintendent of Schools)

Date: \_\_\_\_\_

**Accepted by Board of Education: September 27, 2007**

**BROADEST POLICY PROVISION**

*The District shall establish an assessment system that is aligned with the District's Mission and Vision and provides a comprehensive, consistent and integrated system of student learner objectives / outcomes, assessment, analysis and reporting.*

**EXECUTIVE SUMMARY**

In order to ensure that all students master the objectives of the Greenwich curriculum and achieve to their highest potential, student achievement in science is assessed against three broad groups of indicators: 1) aggregate performance on standardized tests such as the Connecticut Academic Performance Test, 2) preparation for post secondary options including numbers of students taking Advanced Placement courses and average scores on AP Tests, and 3) aggregate performance on local curriculum assessments administered in grades 3-8.

Accomplishments include: compliance with the policy; curriculum alterations to ensure alignment with state standards; successful incorporation of the state's "embedded tasks" into the curriculum; an increased number of students enrolled in AP science courses and an increase in the average score on AP exams; a Proficiency rate of 90% or higher rate on CAPT over four years; some closing of achievement gaps; and, an aggregated average on local assessments above 80%.

While there are no major exceptions to any policy provision, there are a number of governance and management issues which require further attention. Governance issues include: graduation requirements both in number of years of science study and CAPT science achievement; the sequence of courses at GHS and their alignment with state standards; and, our struggle to attract and retain qualified science teachers. Management issues involve: erosion of science instructional time at the elementary level; difficulty in collecting useful data and in measuring overall student growth (grades 3-8) using the Local Curriculum Assessment instruments; the need for curriculum mapping; competing district priorities for professional learning; reorganizing the biology and chemistry curricula to completely align with state standards; the lack of

overlapping objectives among levels of the same subject; and, the effects of a fragmented K-8 and 9-12 program.

**Note:** Descriptions of the measures discussed in the next three sections and data tables describing student achievement over the last five years are attached at the end of this report.

## **ACCOMPLISHMENTS / HIGHLIGHTS**

1. Beginning in 2000 a comprehensive review of the K-12 science curriculum was undertaken. The review resulted in a significant rewriting of the existing K-8 science curriculum and the addition of ESL specific science courses at GHS. The changes to the elementary and middle school curricula were extensive. The implementation of the new objectives was completed over the following two school years, 2002-03 and 2003-04.
2. Following the adoption of an expanded science curriculum in 2002, a series of grade-level unit assessments were developed for the purpose of evaluating the effectiveness of the science curriculum. The middle school teachers began administering the assessments in grades 6 through 8 in 2002-2003 and the elementary teachers followed in 2003-2004. (For additional discussion of grade-level assessments see Management Issues #2)
3. In 2004 the State Department of Education released the Connecticut Science Frameworks which quickly became a guiding document for school systems interested in reviewing their local science curricula. Greenwich took advantage of this opportunity to address a number of alignment and instructional time issues with the new science objectives as well as apply the Understanding by Design format to the entire K-8 document. As a result, the GPS curriculum now has a better balance of inquiry skills and factual content.
4. In the spring of 2004 a team of middle school science teachers began a discussion around differentiating content and skills for exceptionally talented middle school students. As a result of this work, in the fall of 2004, each middle school began offering an advanced level science course in grades 7 and 8. The course content closely followed the grade-level objectives to ensure that our students would be prepared to take the science CMT in grade 8, but allowed for students to study core concepts in a homogeneous group and with greater depth.
5. Beginning with the 2008 spring administration of the CMT, students in grades 5 and 8 will be tested on a selection of concepts and skills including questions related to students' observations made while completing the "Connecticut Science Curriculum Embedded Performance Tasks". Through professional learning, all middle school teachers are prepared to teach these embedded tasks. (See Management Issues #4 for discussion of preparation of elementary teachers).
6. Beginning in the fall of 2006, the GHS science department began preparations for the 3<sup>rd</sup> Generation CAPT exam. One of the major tasks was incorporating the ten embedded tasks, learning labs and activities created by the state, into the current curriculum. Alterations were

made to the existing biology and chemistry curricula to accommodate changes in the state standards. These alterations are also reflected in midterm and final exams, which now include sections devoted to material directly from the embedded tasks. Furthermore, teachers developed and are using shared formative assessments for the embedded tasks.

7. The number of GHS students taking science courses has increased over the past five years. This is due to, in part, to an increased requirement (three years) in the number of science credits needed to graduate from high school (beginning with the graduates of 2007). It is also due to increased student interest in upper level courses at the high school. This trend is especially evident in some of our AP courses which have shown enrollment growth over the past five years. (See Table 3.)
8. AP science scores continue to remain high, even with an increased number of students taking the exam. The average this past year, 3.79, is the highest that it has been in the past five years. (See Table 3).
9. The gap in CAPT Science scores for Free and Reduced Lunch students and other students at Greenwich High School has narrowed over the past four years. Although the number of students scoring at “Advanced” has remained relatively flat over this time period, the number of students scoring in the Mastery and Proficient categories has increased. Gaps were also narrowed with special education students. Special education students’ scores rose in all three categories of scoring, with a major jump in the number of students at Mastery and Proficient. (See Table 2).
10. During the 2006-2007 academic year, 22 students were enrolled in the Honors Independent Research program at GHS. In this program, students are given the unique opportunity to pursue an independent research project of their own choosing, and encouraged to participate in the Junior Science and Humanities (JSHS) Conference, and the Connecticut State Science Fair. This past year at JSHS, GHS was awarded three of only 12 statewide positions for oral presentations and two earned a trip to the national JSHS. At the Connecticut Science Fair, nine GHS students from the Independent Research Program participated, seven were selected as finalists and two won the top prizes for the entire fair.

## **GOVERNANCE ISSUES**

1. Given the knowledge and skills required to succeed in a twenty-first century global economy, should the science graduation requirement be increased from three credits to four credits? Are the graduation requirements as stated in policy sufficiently rigorous to ensure a high quality education for all students? Is there sufficient latitude within these requirements to address the needs of all students? Moreover, should we include a series of performance tasks/expectations of all students that are specified not as credits (seat time) but as knowledge and skills we believe all students should attain?

2. Currently, the only CAPT subject area test that is *not* a graduation requirement is science. Unfortunately, because CAPT science is not required, a common notion among sophomore test takers is that the science test (always taken on the last day of testing) “does not count.” Should the district alter this requirement? What additional responsibilities would be placed on the school for students who score under proficiency? What sort of evaluation would suffice for students unable to score proficiency after multiple times?
3. The State’s core standards align to a ninth grade physical science class and a tenth grade biology class. While progress has been made recently, we lag many districts in completely re-aligning to the state standard. Our chemistry curriculum now must include concepts typically taught in a physical science or introductory physics course. Should the Greenwich School District adopt the sequence that best aligns with state standards? If this sequence were adopted, what kind of changes in staffing would we need?
4. Attraction and retention of qualified science teachers had become increasingly difficult at Greenwich High School. Just over the past two years, the department has hired nine new science staff members, a turnover rate of almost 30%. The principal reasons these teachers give for leaving the district are: relocation, significantly better salaries (Westchester County), dissatisfied with the commute, and unable to purchase a home in the immediate area. Additionally, we have found that our first and second choices to fill vacancies have turned down positions in Greenwich in favor of teaching further upstate. How can the district ensure that we retain the excellent staff that we have and attract qualified new science teachers?

## MANAGEMENT ISSUES

1. Beginning with the adoption of the revised science curriculum in 2002, there has been growing evidence of an erosion of science instructional time at the elementary level. Data suggest that increased competition for instructional time during the school day for literacy, social studies, mathematics and FLES has reduced available time to teach the science curriculum. Several schools did not report complete curriculum assessment data because the science units were not taught.

### Progress on this issue

With fewer elementary new initiatives scheduled, it appears that schools can refocus instructional time and attention on the science objectives while at the same time prepare students for the 2008 CMT’s. The Science Coordinator will meet with principals and teachers in schools that need assistance in mapping out coverage of the entire curriculum. A greater effort will be made to communicate this clearly to principals and teachers.

2. It is difficult to report results on overall student growth (grades 3-8) using the Local Curriculum Assessment instruments for several reasons. First, individual assessment units have changed to reflect State of Connecticut Core Content Standards. As a result, the data reflect a consistent testing instrument only since 2005-2006. Second, data from

different levels of classes in the middle school (advanced and regular) have been co-mingled. The result is an aggregate number that provides little information about student science achievement in middle school. Third, we currently lack the means to report on individual or cohort growth. A summary of the curriculum assessment results for years 2002 -2007 is included in the Table 1.

#### Progress on this issue

The assessments in grades 3-8 have remained constant for the last two years and this should help us better measure the effectiveness of the curriculum materials and students' grasp of the important concepts and skills. Steps are being taken to refine data collection practices on local assessments so that clean and meaningful data can be reported out to teachers, administrators, central office and the Board. We also look forward to the administration of the CMT in grades five and eight this spring as a statewide measure of student preparedness in science. The results of the science CMT will provide a benchmark upon which to measure future program changes.

3. There is a need for a curriculum map in science for grades kindergarten through senior year. Curriculum mapping would allow us to ensure alignment with state standards and to identify major gaps and overlaps in significant curricular areas. It would also allow administrators, teachers, or any other observer to identify exactly what we expect from our students and teachers at every grade level.

#### Progress on this issue

We began the process of mapping the curriculum for grades K-5 and have plans in place to expand the mapping to 6-8 and 9-12.

4. Training and supporting elementary staff as they implement the science program has been difficult in the face of competing district priorities. Many new classroom teachers have not attended professional learning opportunities to familiarize themselves with some of the state required embedded tasks or the sophisticated concepts and skills that are taught at this level. Time for professional learning opportunities is limited and often teachers face competing priorities for their time.

#### Progress on this issue

As noted earlier, we anticipate fewer new initiatives than in the past. This may result in fewer requirements on teachers to attend specific professional learning activities and should provide more choice among offerings. We will continue to offer science content and inquiry-based workshops, and, if necessary, mandate that teachers attend. We will also continue to train principals to serve as instructional leaders in their schools. We would also like to explore the idea of making a Science Coach available to staff to support instruction in the K-5 classroom. Additionally, beginning in 2005 we established a number of links between the K-8 science, mathematics, language arts, social studies and technology education curricula. The new Everyday Math program includes

“science projects” at almost every level that promote data collection and analysis through graphing activities. Going forward, through curriculum review and through professional learning, we need to make the connections amongst curricula explicit to teachers.

5. As of last year, different levels of the same course at GHS taught and assessed different, non-overlapping, objectives. This practice made it difficult to compare the achievement of students in one level to another. As a result, the science department lacked the ability to draw conclusions about gap closing or acceleration measures.

Progress on this issue

One goal for the curricula at GHS is for all levels of biology, chemistry and physics to have overlapping student objectives. The “practical” classes would cover the “core” material taught to every student and would completely align with state standards. The “regular” level classes would build significantly from the “core” in depth, breadth and speed of coverage of topics thus meeting state standards as well as preparing students for upper level courses like AP. The honors classes would include in-depth coverage of topics preparing students for AP and standardized tests such as the SAT II’s.

6. Greenwich CAPT scores in science continue to lag other districts in our DRG. Where Greenwich students ranked fourth or fifth in CAPT reading, writing and math, our science scores are near the bottom of DRG B. In 2007, 92% of GPS students scored at the proficient level, but only 62% scored at goal and 33% at advanced. The issue of alignment to state standards has been addressed. A second area of concern is fragmentation into K-8 and 9-12 programs.

Progress on this issue

The Science Coordinator and Program Administrator are setting up at least 1-2 joint high school/middle school meetings and professional learning opportunities. Additionally, we are exploring changes in roles and responsibilities. One proposal under consideration is to split the current job of Program Coordinator for math and science into a coordinator for each program with K-12 responsibilities.

7. Enrollment in AP Biology and AP Physics over the past five years reveals a gender imbalance. Girls outnumber boys in AP Biology by roughly two to one, while boys outnumber girls in AP Physics (although the overall numbers are small) by roughly two to one. AP Chemistry is more evenly distributed. (See Table 4)

Progress on this issue

The gender gap will be monitored. Professional learning will heighten teachers’ awareness of the issue. Efforts will be made to encourage more girls to take AP Physics and boys to take AP Biology. We will report gender data to the Board on an annual basis.

## **EXCEPTIONS**

1. None

## DESCRIPTION OF STANDARDIZED MEASURES

The **Connecticut Mastery Test (CMT)** is a state-mandated program that assesses and reports the achievement of students in grade three through grade eight. Beginning in 2008 the number of areas tested will increase from three to four areas: Mathematics, Reading, Writing and (in grades five and eight) Science. Prior to the 2005-2006 school year, the CMT was administered in grades four, six and eight. The CMT assesses core academic competencies and serves as a key indicator of a student's readiness to successfully access the high school curriculum. Student scores are characterized by performance level: 5-Advanced, 4-Goal, 3-Proficient, 2-Basic and 1-Below Basic. Students scoring at the advanced level are performing at the top of all students across the state. Students scoring in the goal category possess the knowledge, ability, and skill necessary to successfully perform the tasks and assignments appropriately expected of a student with minimal teacher assistance. Students who score in the proficient category are able to successfully participate in their regular grade appropriate course work. The proficient standard is used to calculate adequate yearly progress under No Child Left Behind (NCLB). Students scoring below the proficient level require intervention to accelerate their academic progress.

The **Connecticut Academic Performance Test (CAPT)** is a state-mandated program that assesses and reports the achievement of tenth grade students in four areas: Mathematics, Science, Reading Across the Disciplines, and Writing Across the Disciplines. Student scores are characterized by performance level: 5-Advanced, 4-Goal, 3-Proficient, 2-Basic and 1-Below Basic. Students scoring at the advanced level are performing at the top of all students across the state. Students scoring in the goal category possess the knowledge, ability, and skill necessary to successfully perform the tasks and assignments appropriately expected of a student with minimal teacher assistance. Students who score in the proficient category are able to successfully participate in their regular grade appropriate course work. The proficient standard is used to calculate adequate yearly progress under No Child Left Behind (NCLB). Scoring at the proficient level or higher on the mathematics, reading and writing subtests is required for graduation from Greenwich High School. Students scoring below the proficient level require intervention to accelerate their academic progress.

**Advanced Placement (AP)** is a College Board-sponsored program administered and operated by Educational Testing Service. The AP Program gives high school students an opportunity to take college-level courses and exams, and earn credit, advanced placement, or both for college. Greenwich High School offers sixteen advanced placement classes in five different disciplines. Examinations are administered in May and scored by the Educational Testing Service. AP Examination grades are reported on a 5-point scale as follows: 5-Extremely well qualified, 4-Well qualified, 3-Qualified, 2-Possibly qualified, 1-No recommendation. Greenwich High School offers two levels of AP physics (B and C), AP Biology, AP Chemistry and AP environmental science.

Local curriculum assessments are administered at the end of each science unit in grades 3-8. Results are summarized in the chart below. Each grade is responsible for either 3 or 4 assessments.

**Table 1: Grade 3-8 Local Science Assessments (average grades)**

<b>Grade</b>	<b>2002-2003</b>	<b>2003-2004</b>	<b>2004-2005</b>	<b>2005-2006</b>	<b>2006-2007</b>
<b>3</b>	NA	93.1	87.8	92.2	80.79
<b>4</b>	NA	85.6	83.8	82	86.0
<b>5</b>	NA	88.4	88.4	88.6	88.3
<b>6</b>	81.6	88.1	87.5	86.25	86.03
<b>7</b>	75.3	81.5	76.9	80.75	80.79
<b>8</b>	79.6	81.5	83.5	76.0	70.5

**Table 2: Connecticut Academic Performance Test Science (%)**

		02-03	03-04	04-05	05-06	06-07
GHS (all students)	Advanced	29	28	43	34	33
	Goal	62	56	65	59	62
	Proficient	95	89	91	90	92
Asian	Advanced	37	27	53	40	41
	Goal	66	68	71	64	74
	Proficient	94	95	98	98	91
Black	Advanced	The number of students in this subgroup is insufficient for reporting purposes.				
	Goal					
	Proficient					
Hispanic	Advanced	3	5	17	10	10
	Goal	32	18	32	31	25
	Proficient	85	62	77	79	79
White	Advanced	32	32	47	39	38
	Goal	67	61	71	66	69
	Proficient	97	92	93	93	95
Female	Advanced	25	27	38	28	33
	Goal	56	55	63	58	59
	Proficient	95	89	93	90	93
Male	Advanced	31	30	48	39	34
	Goal	67	58	67	60	64
	Proficient	96	89	89	90	91
Special Education	Advanced	10	4	12	5	8
	Goal	31	20	25	14	32
	Proficient	88	67	66	56	68
English Language Learners	Advanced	The number of students in this subgroup is insufficient for reporting purposes.				
	Goal					
	Proficient					
Free or Reduced Lunch	Advanced	4	2	9	7	8
	Goal	27	16	17	19	21
	Proficient	81	60	61	68	79

**Table 3: Advanced Placement Science\***

		02-03	03-04	04-05	05-06	06-07
Biology	# Tested	67	59	66	71	112
	Mean Score	3.7	4.0	4.3	4.2	4.1
Chemistry	# Tested	47	42	74	65	66
	Mean Score	3.8	4.0	3.2	3.5	3.4
Environ Science	# Tested	56	53	57	31	22
	Mean Score	2.4	2.6	2.2	3.5	3.3
Physics B	# Tested	44	16	22	8	17
	Mean Score	3.1	1.7	3.3	3.4	3.0
Physics C	# Tested	16	10	24	13	23
	Mean Score	3.9	4.3	3.4	3.9	4.4

\* approximately 26% of Free and Reduced Lunch students participate in AP science courses.

**Table 4: Advanced Placement Biology and Physics by Gender**

		2003	2004	2005	2006	2007
Biology	Male	18	26	20	48	25
	Female	42	40	55	71	51
Chemistry	Male	25	31	40	37	47
	Female	23	42	33	45	53
Physics B	Male	13	19	9	21	19
	Female	7	4	5	3	6
Physics C	Male	6	16	9	20	16
	Female	4	9	9	8	7