Evaluation Brief

Americans are no longer surprised when they see reports indicating that our students aren't stacking up well on international rankings. As Dr. Sally Ride, astronaut and physicist, said to a leadership forum at Babson College, "It is ironic that our society, which relies so much on science and technology … now puts so little value or emphasis on science education. Strong science education needs to start early, and continue through middle school, high school and on into college."

In terms of science knowledge, American students do not even rank in the top 10 percent when compared to students from other industrialized nations. For example, U.S. fourth graders ranked 6th out of 25 on the 2003 Third International Mathematics and Science Study (TIMSS) science test. Our eighth graders performed only slightly better, ranking 9th out of 45. Similarly, only about 29 percent of American fourth and eighth graders and a dismal 18 percent of twelfth graders scored at or above *Proficient* on the 2005 National Assessment of Educational Progress (NAEP) science tests. According to the National Assessment Governing Board, the governing body for the NAEP, in order for students to reach the *Proficient* level they must demonstrate competency over the subject matter and be able to apply that knowledge to real-world situations.

The Problem of All-Encompassing Curricula

A body of research points to deficiencies in curriculum as a possible cause of students' lackluster performance in science[1]. It indicates that most elementary and secondary science curricula introduce too many topics, resulting in inadequate coverage of topics and therefore a lack of conceptual development. The research also suggests that there is a lack of interconnectedness among topics in science curricula in the United States, resulting in curricula that are heavy on the number of concepts but lacking meaningful connections. One remedy put forth is to limit the number of topics, mandate when they are introduced, and ensure that they are taught throughout the primary and secondary years.

A growing number of respected educators and researchers agree, and are suggesting that a targeted curriculum would provide the clarity and focus that many state and local curricula lack. Educators are embracing educational initiatives such as "Big Ideas in Science," which is a concept that "certain topics of science have a greater potential for a lasting and meaningful effect on the world, as well as on the physical and mental well-being of humanity." [2] The National Science Teacher's Association (NSTA) has proposed an initiative, *Science Anchors*[3], to serve as a focused science framework. A curriculum developed around the core topics as proposed within *Science Anchors* would encapsulate the science skills and topics that are nationally recognized as essential.

The Benefits of Video Instruction

A number of studies point to the efficacy of using video and multimedia lessons to improve the science achievement of elementary students. While research supporting the effectiveness of video enhancement is particularly plentiful as it relates to ESL students[4], the benefits to the general population of learners should not be overlooked. Researchers Nueman and Koskinen[5], for example, found that students watching closed-captioned television consistently outscored control group students in word knowledge and recall of science information. Other researchers confirm that it is easier for students to remember the visual scenes and audio effects that help describe the context of target words than it is for them to remember word definitions from a glossary. [5]

*SRA Snapshots Video Scienc*e™

With this body of evidence in mind, SRA/McGraw-Hill set about to create an elementary science instructional model that increases student achievement by combining what is known about the impact of video instruction with a more focused set of core topics and key vocabulary that offer connections to students' real-lives. The result is *SRA Snapshots Video Science™.*

SRA Snapshots Video Science™ is a supplemental science program designed to help students in grades 3–5 master core science concepts and difficult science vocabulary. The program uses instructional videos in combination with a closely aligned textbook to help students grasp key vocabulary and become excited about learning science. The program has three instructional levels (A, B, and C, targeted toward grades 3, 4, and 5, respectively). Each level has nine chapters, with three lessons each. This study describes the effects of the program in actual practice.

Methodology

The main purpose of this study was to determine what effect *SRA Snapshots Video Science™* has on science achievement. SRA/McGraw-Hill selected Blue Ridge Elementary School, in the Fort Bend Independent School District in Houston, Texas, in which to test the program. Blue Ridge's student population (PreK–5) is 83% Black, 16% Hispanic and 1% White. The school has a high incidence of economically disadvantaged students, with 73% eligible for free or reduced meals.

A secondary purpose of this study was to see what impact historically significant demographic variables such as race, gender, socioeconomic status (SES), special education status, and English proficiency have on science achievement in the upper elementary grades. The assumptions about these variables were tested by randomly assigning 151 third through fifth graders to use the program for the entire 2007-08 school year; another 112 students were randomly assigned to a control group. SRA/McGraw-Hill consultants trained teachers to implement *SRA Snapshots Video Science™* and periodically monitored instruction throughout the year.

Data Analyses and Findings

The core concepts covered by *SRA Snapshots Video Science* are well aligned to the curricula of this particular school district. It is noteworthy that the school's science scores went from **last place** in the district (spring 2007) to **first place** (spring 2008). The only change in the science curriculum over this period was the introduction of *SRA Snapshots Video Science*™. It is clear that a program aligned well to selected topics, as recommended by the NSTA, is particularly effective.

SRA/McGraw-Hill was also curious to see the effects of the program when tested against the broader range of topics that are typical of standardized national tests. Although random assignment often negates the need to pretest students, in the fall of 2007, SRA/McGraw-Hill administered the science portion of the *TerraNova California Achievement Test, Sixth Edition* to all students using *SRA Snapshots Video Science*™. In the spring of 2008, these students took the posttest. A graphical display (boxplot) of the posttest scores revealed five outliers (extreme scores) among the *SRA Snapshots Video Science*™ students. SRA/McGraw-Hill chose to retain these scores in the analyses after determining that they did not significantly impact the mean score of this group (mean = 635 with outliers included, mean = 638 with outliers omitted).

Figure 1 indicates that student populations in Grades 3, 4, and 5 all experienced gains from pretest to posttest. Table 1 shows the actual effect of the program. Although the 6-point scale score gain at third grade was not statistically significant, the average effect size for all three grade levels was .71, which suggests that, on average, students gained 26 percentile points after being exposed to *SRA Snapshots Video Science*™. The largest gain was by fifth grade students, with an effect size of 1.1 (36 percentile points). By any standard, this is an impressive gain.

Figure 1

Gains of Students using *SRA Snapshots Video Science*™

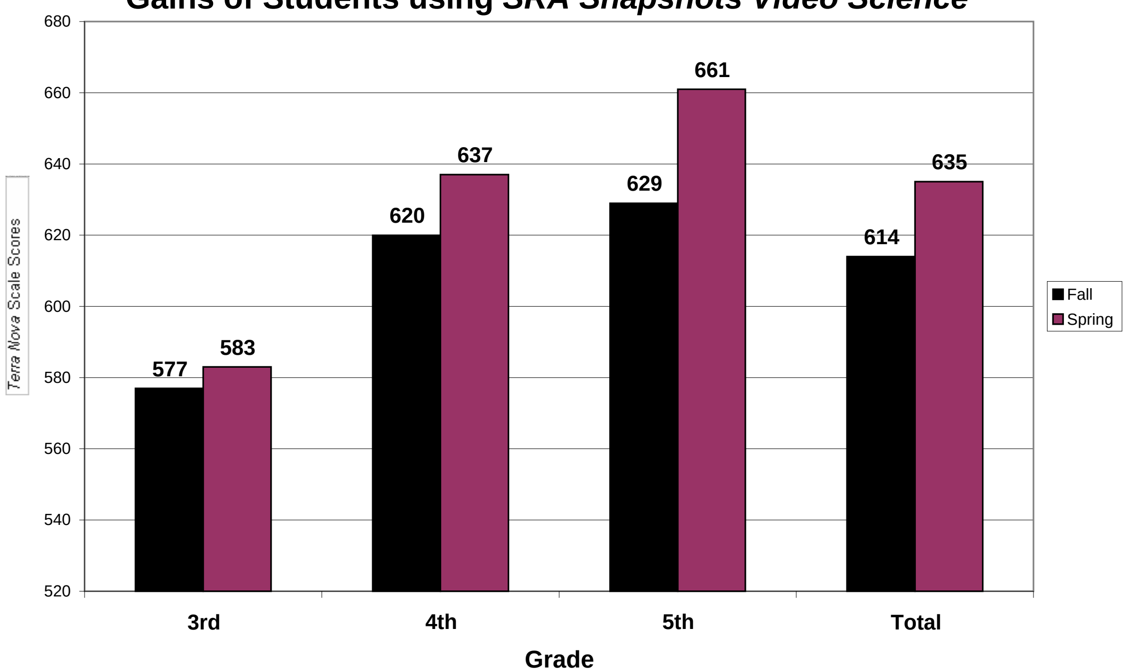

Table 1. Program Effect by Grade on *TerraNova* Science

Grade	Pretest Mean	Posttest Mean	Mean Difference	Effect Size (Hedges's g)
3^{rd}	577	583	+6	+.19
4^{th}	620	637	+17	+.85
5^{th}	629	661	+32	+1.1

Effects of Program and Key Demographic Variables

Before running the regression analyses to investigate the effects of the program on student achievement when key demographic characteristics are taken into account, researchers checked to see if the selected explanatory (independent) variables were highly correlated with each other (multicollinearity). Special education status and English language proficiency were the two most highly correlated explanatory variables (.56), which is not surprising since many non-English speakers also receive special education services. Had the correlation coefficient been much larger, one of these variables would have been dropped because the individual effect on science achievement could not have been determined. The following unrestricted regression model shows all the explanatory variables that were used to explain science achievement:

$$Y_i = B_0 + B_1D_{1i} + B_2D_{2i} + B_3D_{3i} + B_4D_{4i} + B_5D_{5i} + B_6D_{6i} + B_7D_{7i} + u_i$$

where:

Y_i= science achievement
B_0 = the intercept (constant)
D_1 = condition (1= *Snapshots* subscriber, 0 = non-subscriber)
D_2 = race1 (1= Hispanic, 0 = Else)
D_3 = race 2 (1= Other, 0 = Else)
(Black was the excluded category and there were no White students in the sample)
D_4 = gender (1 = male, 0 = female)
D_5 = free/reduced meal status (1 = yes, 0 = no)
D_6 = English language learner status (1 = yes, 0 = no)
D_7 = special education status (1 = yes, 0 = no)
u_i = error unaccounted for by the model

As seen in Table 2, students using *SRA Snapshots Video Science*™ scored on average 21 scale score points higher on the *TerraNova* science tests than their control group counterparts, holding all other variables constant. Not surprisingly, students who qualified for free or reduced priced meals scored on average 28 scale score points less than their counterparts. What was a bit unexpected, however, was the finding that English language learners scored significantly better on average than students who are proficient in English. The results are quite similar in Model 2, which excludes the non-significant variables from Model 1. The adjusted R-square remained virtually unchanged from Model 1 (.21) to Model 2 (.20), confirming that neither race, gender, special education status contributed to the explanation of difference in science test scores.

Adjusted R-square indicates the amount of variation in science achievement that can be explained by the explanatory variables. For example, Model 1 achieved an adjusted R-square of .21, which means 21 percent of the variance in the *TerraNova* science test scores can be explained by students' exposure to the program, their race, gender, socio-economic status, level of English proficiency, and special education status. These findings are consistent with those of other education studies.

Table 2.
Effects of *SRA Snapshots Video Science*™
and Key Demographic Variables

Explanatory Variables	**Model 1**	**Model 2 (non significant variables excluded)**
	Coefficient (p-value)	**Coefficient (p-value)**
SRA Snapshots Video Science™	21.172 (.000)	22.185 (.000)
Hispanic	5.080 (.405)	
Other	-62.264 (.093)	
Gender	Nonsignificant	
Free/reduced meals = Socio Economic Status	-28.150 (.000)	-30.089 (.000)
English lang. learner	24.621 (.002)	23.678 (.000)
Special education	-1.439 (.859)	
Constant	638.766 (.000)	636.427 (.000)
N	234	234
Adjusted R-square	.213	.203

Conclusion

It is clear from these findings that *SRA Snapshots Video Science*™ hits the mark in its combination of targeted topics and video presentation. A mean score increase of 32 percentile points is an impressive gain. And,while the program may not have been developed as a remedial action targeted toward ESL students, the research and these results make it difficult to state the benefits to the mainstream science classroom without commenting on the added benefit to ESL students.

Endnotes

[1]Schmidt, W. & Prawat, R. (2006). Curriculum Coherence and National Control of Education: Issue or Non-Issue? ((ERIC Document Reproduction Service No.EJ753818).

(Xin, J.F. & H. Reith, 2001). Information Technology in Childhood Education, P. 87.

Laplante, B. (1997). *Teaching Science to Language Minority Students in Elementary Classrooms.* NYSABE Journal. 12, 62-83

[2]Georgia Framework for Learning Mathematics and Science http://www.coe.uga.edu/framework/chapters/3four.html

[3]Miller-Whitehead, M. (2002). *Class Size and Student Science Achievement: Not As Easy As It Sounds.* (ERIC Document Reproduction Service No. ED470676.

[4] http://www.nsta.org/publications/news/story.aspx?id=53706

[5]Nueman, S. & Koskinen, P. (1991) *Captioned Television as "Comprehensible Input": Effects of Incidental Word Learning from Context for Language Minority Students (Report).* Lowell, MA: Education Department and the Center for Field Studies at the University of Lowell. (ERIC Document Reproduction Service No. ED332538).