

**LSC Analytic Memo  
Student Achievement  
STEP-uP  
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**Context of STEP-uP as it relates to Student Achievement**

From its inception, STEP-uP's guiding principles were:

- all children will receive high quality science instruction and STEP-uP will do whatever it takes to make that happen;
- the five elements of science reform (high quality science kits, refurbishment centers, professional development, assessment aligned to standards, community/administrative support) are mandatory in keeping science alive in a literacy/math dominated culture;
- all practices and professional development will model-the-model of a teaching/learning framework that teaches content through inquiry;
- we will think and operate systemically, building capacity of various stakeholders to support science;
- STEP-uP practices and professional development must a positive impact on student achievement across content areas.

Therefore, all professional development and practices targeted student achievement. The culture of the Pikes Peak region, as well as across the country, does not tolerate "just good ideas"; practices must focus on student achievement.

**Practices Intended to Impact Student Achievement**

Primary aspects that targeted student achievement were:

**Kit trainings** (4 hours each)—Training in the management and flow of kit materials is foundational and all teachers in the region are expected to be trained in the implementation of their grade-level kits. Adding conceptual storylines to the kit trainings has allowed teachers to more quickly move from just materials management to an understanding of the concepts and what the targeted learning is.

**Science content courses** (33 or 45 hours of PD)—Our teachers were science-shy and our goal was to make them science-savvy by having them learn science in field-based and lab-based courses—in other words learn science concepts the same way we expect their students to learn science concepts, by acting the role of a scientist. After they got over the shock of this style of learning, they loved it, felt more confident in their science understandings, and better able to use inquiry. Teachers also experienced certain strategies from Marzano's *Classroom Strategies That Work* in these courses, such as similarities and differences, non-linguistic forms of representations, questioning strategies.

**Instructional Strategy Sessions** (3 hours each)—Five strands of ISS were developed. Two strands consisting of 2-3 sessions focused on integrating standards using science as the content core: Integration of Literacy and Science (including use of notebooks), Integration of Math and Science. The other three strands focused on Inquiry, Assessment, and Equity. While our focus was science, these were strategies that could be used across the curriculum. We anticipated, based on earlier research that student achievement would

improve across the curriculum simply by using science kits and that if we made intentional connections even more learning would occur. In order for teachers to get college credit for the ISS, they must write a reflection paper demonstrating how they have used the ISS, successes/weaknesses, and they must provide artifacts demonstrating student work.

**Assessment Development (45 hours ) and Assessment Implementation training (3-hours)**— This aspect of STEP-uP gave our districts confidence that their teachers were focused on student achievement. Scoring of assessments along with reflection keeps the focus on student achievement and next steps to take to ensure that achievement.

**Professional Development Embedded within the Classroom (Mentoring, Critical Friends Groups, Lesson Study)**—Science Resource Teachers working directly in the classrooms to mediate instructional practices also focused on student learning. Critical Friends Groups often focused directly on analyzing student work. Lesson Study involved a number of teachers examining various aspects of instruction that impact student achievement.

#### **Evidence of Impact on Student Achievement**

STEP-uP currently has three sources of evidence of our impact on student achievement: teacher reports, action research, and case studies; Terra Nova Science results in our largest district; and a research project demonstrating relationship of various STEP-uP PD participation and improved student achievement on CSAP in reading, writing, and math (5<sup>th</sup> Science CSAP will first be administered spring 2006).

When STEP-uP began only about half of the teachers in the region were teaching science kits. As that number increased each year, teachers reported higher interest in science and that students were more motivated to read and write in science. They reported that special ed students had fewer issues in science because of their learning style needs being met. Teacher stories also started filtering to us about what they suspected were improved writing CSAP scores as a result of implementing science notebooks. Action Research is conducted in the Colorado College Master of Teaching in Integrated Natural Science (for which STEP-uP provides scholarships), in the Principals' Institute and among the Science Resource Teachers. Various Action Research demonstrated effects on student achievement.

In the fall of 2004, our largest district administered the Terra Nova Science to all 5<sup>th</sup> grade students. They also administered the Terra Nova Reading, Writing, and Math sections. Across the district the highest scores were in science—great news. Even better news was that in science, achievement was not defined by economic status of the school. In fact, the highest scoring school was a high minority, low economic school that had over 90% of the teachers participating in at least one 45-hour STEP-uP content course. In the spring of 2006, Colorado will administer the first 5<sup>th</sup> Science CSAP and 40-60% of the test items will be Terra Nova items. So we are anticipating good results.

Dr. M. Jean Young and Dr. Marie Revak recently completed a correlation study of specific STEP-uP courses and student achievement on CSAP Reading, Writing, and Math. While their research has only been shared verbally with our five districts, our Advisory Board

recommended in May 2005 that they go forward with publishing their findings. Briefly, they used regression analysis with a 5<sup>th</sup> grade n of 2463, 4<sup>th</sup> grade n of 2067, 3<sup>rd</sup> grade n of 1674, and 2<sup>nd</sup> grade n of 1373 and used a .01 level of significance. They disaggregated for gender, minority status, ILP status, ELL status, and free/reduced lunch.

## Significant Training Correlations

	Reading	Writing	Math
PD Hours			
Science Kit Hours			
Science Notebook	X	X	X
Science and Literacy	X	X	X
Science and Math			
Science and Graphing		X	X
Science Assessment	X	X	X
MAT Hours			

The combined training effects and cumulative training effects were impressive. In the following charts the CSAP rubric level changes are indicated, i.e. (P-L equals Proficient Low), (A-L equals Advanced Low).

## Combined Training Effects

(5<sup>th</sup> Grade Teacher PD)

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>■ Reading               <ul style="list-style-type: none"> <li>■ Science Notebook</li> <li>■ Science and Literacy</li> <li>■ Science Assessment</li> </ul> </li> <li>■ Writing               <ul style="list-style-type: none"> <li>■ Science Notebook</li> <li>■ Science and Literacy</li> <li>■ Science and Graphing</li> <li>■ Science Assessment</li> </ul> </li> <li>■ Math               <ul style="list-style-type: none"> <li>■ Science and Graphing</li> <li>■ Science and Literacy</li> <li>■ Science Notebook</li> <li>■ Science Assessment</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>■ Reading Gain               <ul style="list-style-type: none"> <li>■ From: 608.4 (P-L)</li> <li>■ To: 616.7 (P-L)</li> </ul> </li> <li>■ Writing Gain               <ul style="list-style-type: none"> <li>■ From: 503.1 (P-L)</li> <li>■ To: 514.8 (P-L)</li> </ul> </li> <li>■ Math Gain               <ul style="list-style-type: none"> <li>■ From: 506.8 (P-L)</li> <li>■ To: 523.2 (P-M)</li> </ul> </li> </ul> |
|--|---|

## Combined Cumulative Training Effect

	5 <sup>th</sup> only	4 <sup>th</sup> & 5 <sup>th</sup>	3 <sup>rd</sup> – 5 <sup>th</sup>	2 <sup>nd</sup> – 5 <sup>th</sup>
	n=2463	n=2067	n=1674	n=1573
<b>Reading</b> (Minimum Training)	608.4 (P-L)	617.2 (P-L)	619.6 (P-L)	← <b>Stability</b>
<b>Reading</b> (Maximum Training)	616.7 (P-L)	641.4 (P-M)	644.8 (P-M)	
<b>Writing</b> (Minimum Training)	503.1 (P-L)	506.9 (P-L)	513.4 (P-L)	←
<b>Writing</b> (Maximum Training)	514.8 (P-L)	526.5 (P-M)	536.2 (P-M)	
<b>Math</b> (Minimum Training)	506.8 (P-L)	511.5 (P-L)	519.8 (P-M)	521.6 (P-M) ←
<b>Math</b> (Maximum Training)	523.2 (P-M)	547.9 (P-H)	567.5 (A-L)	570.0 (A-L)

## Effect of Training on Sub-Groups

(Effect was greater on sub-group than comparison group for CSAPs listed)

	Science Notebook	Science and Literacy	Science and Graphing	Science Assessment
Free or Reduced Lunch				
ILP		Reading		
ESL or ELL				Writing
Minority	Math	Writing Math	Reading Writing Math	
Female	Reading Writing Math	Reading Writing Math	Reading Writing Math	Writing Math

## Summary of Findings - Training

- More PD is not necessarily better
- Some types of training have higher correlation with CSAPs than others
  - Notebook training
  - Literacy training
  - Graphing training
  - Assessment training
- Combined training correlation is smaller than the sum of the individual training correlations
- Biggest impact is on Math
- There is a cumulative effect
- There is an effect due to stability
- Some training has a greater effect on ILP students, minority students, and females

Implementation was measured through a validated survey along with observations and artifacts. Implementation constructs that impact student achievement on CSAP are:

## Significant Implementation Correlations – Science Notebooks

	Reading	Writing	Math
Notebooks have student reflections to teacher-generated questions	X	X	X
Notebooks have students' own reflections	X		
Notebooks have notes and diagrams from kit-based or other science activity	X	X	X
Notebook has measurements	X	X	X
Notebooks have a table of contents	X	X	X

## Significant Implementation Correlations – Science and Literacy

	Reading	Writing	Math
Students give oral reports or presentations (not reporting out)	X	X	X
Students report out findings from group or individual work	X		X
Students share their findings or explanations with one another	X	X	

## Significant Implementation Correlations – Science Assessment

	Reading	Writing	Math
Teachers provide rubrics for students			X
Teachers ask questions to assess student understanding	X	X	X

### Practices Most Responsible for Impact on Student Achievement and Why

In fact, STEP-uP believes that all of the practices listed above have an impact on student achievement as demonstrated by teacher reports, action research, Terra Nova results and results of the correlation study. In addition, each aspect of our professional development reinforces other aspects and in that sense is iterative, with each supporting and impacting

other components, making a cohesive whole. Therefore, teachers have multiple and varied opportunities to "get it" and to demonstrate their understandings. That level of intensity and comprehensiveness, plus fidelity to the inquiry teaching/learning framework, impact student achievement.

Next steps for STEP-uP to determine student achievement are: mine current data for other correlations, propose a similar study using next spring's 5<sup>th</sup> Science CSAP, research the effects of conceptual storylines and assessments, and research the predictive value of STEP-uP assessments with 5<sup>th</sup> Science CSAP. All of these studies should be complete by fall of 2006.