DATE: March 23, 2010

TO: BOARD OF EDUCATION

FROM: Dr. Joe A. Hairston, Superintendent

SUBJECT: REPORT ON PROJECT SEED

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RESOURCE PERSONS: Tamela Hawley, Director, Office of Research
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INFORMATION

That the Board of Education receive the Project SEED Evaluation report.

Attachments – Project SEED Evaluation
             Project SEED Evaluation - PowerPoint
Project SEED Program Evaluation

February 6, 2010

A report commissioned
by
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Executive Summary

Project SEED is a nationwide program in which professional mathematicians teach abstract, conceptually oriented mathematics to full-sized classes of elementary school children on a daily basis as an extra-period supplement to their regular mathematics program.

The purpose of this study is to evaluate the impact of fourteen weeks of SEED instruction on student mathematics achievement in the Baltimore County Schools. SEED was implemented in five schools at the 4th and/or 5th grade levels. The five SEED schools were Featherbed Lane Elementary, Halstead Academy, Milbrook Elementary, Powhatan Elementary, and Woodmoor Elementary.

The primary program goal is to evaluate the impact of the Project SEED methodology on 4th and 5th grade scores on Maryland State Assessment. The secondary goal is to assess the impact of the project on teacher attitudes toward instruction.

The major evaluation questions investigated through this study were as follows:

Question 1: What was the impact of one semester (14 weeks) of Project SEED instruction during the 2008-2009 school year on student mathematics achievement?

Question 2: What was the reaction to the program of Project SEED principals and classroom teachers?

Question 3: How did participation in Project SEED impact the students’ level of performance on the Maryland School Assessment?

Key Findings

1. When given a test of abstract algebra, BCPS students participating in Project SEED scored significantly higher than national comparison groups. Out of 20 possible correct answers, the average score for 4th grade students was 14.88 and on average 5th grade students scored 15.7.

2. A regression analysis predicting MSA Mathematics and Reading scores determined that students’ prior year MSA score in Mathematics was the strongest predictor of their current year scores. Project SEED was found to be a negative predictor of MSA Mathematics in both the 4th and 5th grade groups. This could be a function of the fact that Project SEED students spend most of their time learning higher level algebra, which is not a concept assessed on the 4th and 5th grade Mathematics MSA.

3. 94.5% of teachers believed that SEED had a least somewhat strengthened their understanding of mathematics.
4. 100% of teachers felt that the teaching methods employed by the Project SEED instructors were either extremely or somewhat effective.

5. All teachers believed that the SEED instruction should be used in more classrooms.

6. Principals were positive about the impact of SEED on student learning and self-esteem.

7. Project SEED students are at an advantage for moving from Basic to Proficient on MSA reading in both 4th and 5th grade students. This is probably an effect of the highly verbal nature of the learning process connected to Project SEED instruction.

8. 5th grade Project SEED students have a significant advantage in moving from Basic to Proficient in mathematics.

9. 4th grade Project SEED students show lower growth from Basic to Proficient and the same from Proficient to Advanced in Mathematics. This is probably an effect of the fact that students learn high level algebra concepts which is not tested on the Mathematics MSA in 4th grade.

Future directions discussed include continuing professional development of teachers, possibly expanding the scope of the projects to include more classrooms and/or more content areas, and adjusting the timing of the 14 week sessions so that SEED instruction does not interrupt preparation for the MSA Mathematics assessments. Finally, a focus of future evaluation efforts may benefit from looking into the seemingly strong impact of the Project SEED approach on the language arts development of elementary school children.
Project SEED Program Evaluation

Introduction

Project SEED is a nationwide program in which professional mathematicians teach abstract, conceptually oriented mathematics to full-sized classes of elementary school children on a daily basis as an extra-period supplement to their regular mathematics program.

The Project SEED Method

The mathematics is presented through the use of a Socratic group discovery format in which children discover mathematical concepts by answering a sequence of questions posed by the SEED instructor. For each Project SEED classroom, a Project SEED Mathematics Specialist will teach an algebra lesson as a supplement to the standard mathematics curriculum for four periods per week, while the regular classroom teacher observes and participates. Project SEED staff believe that only persons who understand mathematics in depth possess the versatility to capitalize on the unconventional and often original insights that children are capable of making in an open-ended mathematical dialogue.

The initial mathematical topics are chosen from high school and college algebra to reinforce and improve the students’ critical thinking and computational skills and to help equip them for success in college-preparatory mathematics courses at the secondary level. Subsequent material establishes the mathematical foundation for a number of advanced areas of study and progresses into advanced topics in abstract algebra and other areas. Project SEED teaches entire regular elementary school classes rather than specially selected groups of students. Classrooms participate in Project SEED instruction for 14 week instructional terms. Professional development is provided to teachers through one-on-one modeling provided by the Project SEED specialist along with periodic meetings with teachers to debrief on what they have learned.

Goal of the Program for 2008-2009

The purpose of this study is to evaluate the impact of fourteen weeks of SEED instruction on student mathematics achievement in the Baltimore County Schools. SEED was implemented in five schools at the 4th and/or 5th grade levels. The five SEED schools were Featherbed Lane Elementary, Halstead Academy, Milbrook Elementary, Powhatan Elementary, and Woodmoor Elementary.

The primary program goal is to evaluate the impact of the Project SEED methodology on 4th and 5th grade scores on Maryland State Assessment. The secondary goal is to assess the impact of the project on teacher attitudes toward instruction.
Research Questions

The major evaluation questions investigated through this study were as follows:

Question 1: What was the impact of one semester (14 weeks) of Project SEED instruction during the 2008-2009 school year on student mathematics achievement?

Question 2: What was the reaction to the program of Project SEED principals and classroom teachers?

Question 3: How did participation in Project SEED impact the students’ level of performance on the Maryland School Assessment?

Outcomes and Measures

Each of the research questions stated above has associated measures.

Question 1

The impact of one semester of SEED instruction on student mathematics achievement was measured using two indicators:

1. A final test focused on abstract algebra which focused on group theory (including additive identity, additive inverse, and summing positive and negative numbers and variables) and exponents was administered to students participating in 14-week Project SEED classrooms. This was compared to a national comparison group that was tested on similar algebra concepts.
2. The Maryland School Assessment (MSA) from 2007-2008 to 2008-2009 used as a tool for comparing effect of exposure to Project SEED upon MSA Mathematics scale scores.

Question 2

In order to determine the reaction of school principals and classroom teachers to Project SEED, survey tools were administered. A thirteen item survey that focused on teachers’ perception of the impact of the SEED instruction on their students’ learning was administered to classroom teachers who had Project SEED instructors in their classrooms. A principals’ survey was also administered that focused on principals’ perception of the project on their teachers and students.
Question 3

The impact of Project SEED on students’ level of performance on the *Maryland School Assessment* was measured by comparing the 2007-2008 and 2008-2009 MSA administrations of the Mathematics as well as the Reading assessment in 4th and 5th grades. Students’ movement from one year to the next from Basic to Proficient and from Proficient to Basic levels of performance was compared for differences among Project SEED students and non-SEED students using a chi-square analysis.

*Project Sample and Comparison Group*

The project sample included 386 4th and 5th grade students who had been exposed to Project SEED instruction in academic year 2008-2009. These students were all members of 4th and 5th grade students from the Project SEED schools identified earlier. In order to compare the impact of Project SEED on math and algebra outcomes, a theoretical comparison group was designed. Each student in the project sample (SEED) was systematically matched to a comparison student.

Since the literature indicates that students who have not been exposed to the SEED instruction, but are in the same school and grade as students who are exposed to SEED benefit from this enhanced environment, matching SEED students to students in their own schools was out of the question. Thus, the comparison students were drawn from five district schools that were similar in demographics and performance to SEED schools. These comparison schools all have the common characteristics of having not been exposed to Project SEED, making them adequate comparisons for the SEED group. All matching at the school level was done by members of the Baltimore County Evaluation Department. Variables used in the matching process at the school level were:

1. *MSA (Maryland School Assessment)* Mean Reading pretest score
2. *MSA* Mean Math Total pretest score
3. Percent of students on free or reduced lunch (FARMS)
4. Ethnic percentages

Table 1 shows the matched schools along the demographic variables included in the matching methodology.
Table 1  
Project SEED and non-SEED schools matched by demographics (4th and 5th grades only)

<table>
<thead>
<tr>
<th>School</th>
<th>Number of 4th &amp; 5th Graders</th>
<th>Non-white %</th>
<th>FARMS %</th>
<th>LEP %</th>
<th>Special Ed. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project SEED Schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Featherbed Lane Elementary</td>
<td>190</td>
<td>99.40</td>
<td>71.05</td>
<td>2.11</td>
<td>7.89</td>
</tr>
<tr>
<td>Halstead Academy</td>
<td>160</td>
<td>98.75</td>
<td>78.75</td>
<td>1.88</td>
<td>11.25</td>
</tr>
<tr>
<td>Milbrook Elementary</td>
<td>144</td>
<td>90.97</td>
<td>69.44</td>
<td>7.64</td>
<td>13.19</td>
</tr>
<tr>
<td>Powhatan Elementary</td>
<td>118</td>
<td>94.07</td>
<td>66.10</td>
<td>3.33</td>
<td>8.67</td>
</tr>
<tr>
<td>Woodmoor Elementary</td>
<td>150</td>
<td>100.00</td>
<td>74.01</td>
<td>3.33</td>
<td>8.67</td>
</tr>
<tr>
<td>Non-SEED Schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dogwood Elementary</td>
<td>190</td>
<td>98.95</td>
<td>68.42</td>
<td>2.63</td>
<td>11.58</td>
</tr>
<tr>
<td>Randallstown Elementary</td>
<td>151</td>
<td>99.34</td>
<td>69.44</td>
<td>3.31</td>
<td>4.64</td>
</tr>
<tr>
<td>Riverview Elementary</td>
<td>132</td>
<td>57.58</td>
<td>56.27</td>
<td>2.27</td>
<td>8.33</td>
</tr>
<tr>
<td>Sandalwood Elementary</td>
<td>137</td>
<td>94.16</td>
<td>81.75</td>
<td>6.57</td>
<td>8.76</td>
</tr>
<tr>
<td>Winfield Elementary</td>
<td>139</td>
<td>97.12</td>
<td>63.31</td>
<td>0.72</td>
<td>21.58</td>
</tr>
</tbody>
</table>

Results

*Question 1: What was the impact of one semester (14 weeks) of SEED instruction during the 2008-2009 school year on student mathematics achievement?*

**Algebraic Achievement**

According to a study done by independent evaluator William Webster\(^1\), Baltimore County students in the SEED group significantly outperformed five national comparison groups on Group Theory and Exponents elements of a nationally based algebra test. Tables 2 shows that the overall mean on the Algebra test was 15.11 meaning that students got slightly more that 15 of 20 items correct. Fourth grade Baltimore County students got an average of 14.88 items correct while fifth grade students got 15.7 items correct.

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\(^1\) Please see Appendix A for the Webster report.
Table 2
Summary of Algebra Results, 5 Districts, National Study, and Baltimore County Schools

<table>
<thead>
<tr>
<th>Comparison groups</th>
<th>Grades</th>
<th>Algebra Test Element</th>
<th>SEED N</th>
<th>SEED Mean</th>
<th>Comparison Mean</th>
<th>t-ratio</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>District 1</td>
<td>4-5</td>
<td>Group Theory</td>
<td>292</td>
<td>10.66</td>
<td>5.30</td>
<td>7.10</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exponents</td>
<td>158</td>
<td>12.23</td>
<td>4.05</td>
<td>15.08</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>District 2</td>
<td>4-5</td>
<td>Group Theory</td>
<td>433</td>
<td>11.33</td>
<td>6.17</td>
<td>9.26</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>District 3</td>
<td>3</td>
<td>Group Theory</td>
<td>523</td>
<td>9.10</td>
<td>3.94</td>
<td>13.97</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>District 4</td>
<td>5-6</td>
<td>Exponents</td>
<td>193</td>
<td>11.70</td>
<td>4.30</td>
<td>14.08</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>District 5</td>
<td>4-5-6</td>
<td>Group Theory</td>
<td>175</td>
<td>8.62</td>
<td>3.40</td>
<td>7.03</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exponents</td>
<td>164</td>
<td>9.76</td>
<td>3.95</td>
<td>12.21</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>National Total</td>
<td>3-6</td>
<td>Group Theory</td>
<td>1440</td>
<td>10.05</td>
<td>4.52</td>
<td>19.83</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exponents</td>
<td>515</td>
<td>11.24</td>
<td>4.43</td>
<td>20.20</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Baltimore County</td>
<td>4-5</td>
<td>Group Theory,</td>
<td>386</td>
<td>15.11</td>
<td>4.48</td>
<td>47.40</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SEED group</td>
<td></td>
<td>Exponents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maryland School Assessment (MSA) Achievement

A series of regression analyses was conducted by independent evaluator William Webster. The dependent variables for each regression were the MSA Mathematics and MSA Reading scale scores taken in the 2008-2009 academic year. For each regression, the following variables were controlled for: Project SEED participation; MSA Mathematics scale score taken in 2007-2008; MSA Reading scale score taken in 2007-2008; Gender; Ethnicity; and FARMS status. The regression analyses were conducted independently for 4th grade students and 5th grade students broken down by MSA assessment (Reading and Mathematics) A summary of the results\(^2\) can be found in Table 3. For each model, a significant result is denoted by a sign indicating the direction (positive or negative) of impact upon the dependent variable. If a variable is not significantly related to the dependent variable, it is indicated with the word, “NO.”

Table 3
Effects of independent variables upon MSA outcomes\(^3\)

<table>
<thead>
<tr>
<th>Regression Model</th>
<th>Pre-test</th>
<th>Project SEED status</th>
<th>FARMS status</th>
<th>Gender (1=female; 0=male)</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 4 Math MSA</td>
<td>+</td>
<td>-</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Grade 4 Reading MSA</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Grade 5 Math MSA</td>
<td>+</td>
<td>-</td>
<td>NO</td>
<td>-</td>
<td>NO</td>
</tr>
<tr>
<td>Grade 5 Reading MSA</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

\(^2\) Please see Appendix A for the Webster report.
\(^3\) Please see Appendix A for the Webster report.
Table 3 indicates that there were only four significant relationships found in the four regression equations. For 4th grade Mathematics, the pretest had a positive influence (the strongest effect) and participation in Project SEED had a negative influence. This means that 4th grade students who scored high on the MSA Mathematics assessment in 2007-2008 were more likely to score high on the MSA Mathematics in 2008-2009 and students who participated in Project SEED scored lower than those students who did not participate in Project SEED.

Results were similar for 5th grade Mathematics MSA. Students who scored high on the MSA Mathematics assessment in 2007-2008 were more likely to score high on the MSA Mathematics in 2008-2009 and students who participated in Project SEED scored lower than those students who did not participate in Project SEED. This result may be due to the fact that Project SEED students spend a lot of time working on higher level Algebraic content, which is not the content that is tested on the MSA.

Key Findings:

1. When given a test of abstract algebra, BCPS students participating in Project SEED scored significantly higher than national comparison groups. Out of 20 possible correct answers, the average score for 4th grade students was 14.88 and on average 5th grade students scored 15.7.
2. A regression analysis predicting MSA Mathematics and Reading scores determined that students’ prior year MSA score in Mathematics was the strongest predictor of their current year scores. Project SEED was found to be a negative predictor of MSA Mathematics in both the 4th and 5th grade groups. This could be a function of the fact that Project SEED students spend most of their time learning higher level algebra, which is not a concept assessed on the 4th and 5th grade Mathematics MSA.

Question 2: What was the reaction to the program of SEED principals and classroom teachers?

Teacher attitudes

A thirteen item survey was administered to classroom teachers who had Project SEED instructors in their classrooms. Figure 1 presents the survey questions and possible responses.

Out of 19 responses, seventeen teachers (94.4%) believed that SEED had at least somewhat strengthened their understanding of mathematics whereas 100% of those responding felt that the teaching methods employed by the Project SEED instructors were either extremely or somewhat effective.
The strongest positive responses related to the program’s impact on student participation and enthusiasm, motivation to learn, and building self-confidence. Teachers were a little more skeptical, although still positive, about the program’s impact on critical thinking skills, peer interaction, and communication skills. Probably the most telling statistic was that all 15 teachers that responded to question #13 believed that the type of instruction implemented by SEED staff should be used in more classrooms.

### Figure 1. Project SEED Teacher Survey

1. How many years have you had Project SEED classes?
   - A: 1 year, B: 2 years, C: 3 years
2. How many years have you been teaching?
   - A: 1 year, B: 2-5 years, C: 6-10 years, D: 11 years or more
3. Do you have a college major or minor in mathematics?
   - A: Yes, B: No
4. Has Project SEED strengthened your understanding of mathematics?
   - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
5. How effective are the teaching methods employed by the Project SEED instructors?
   - A: Extremely effective, B: Somewhat effective, C: Not very effective, D: Not effective at all
6. How would you rate the student enthusiasm and participation during the Project SEED instruction?
   - A: Excellent, B: Good, C: Fair, D: Poor
7. How well do the Project SEED lessons stimulate student interest in mathematics?
   - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
8. Have the Project SEED lessons helped students improve their critical thinking and problem solving skills?
   - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
9. Does Project SEED motivate students to learn?
   - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
10. How well do the Project SEED lessons build students’ self-confidence?
    - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
11. Does Project SEED help students relate to their peers more positively?
    - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
12. Has Project SEED helped students improve their communication skills?
    - A: A great deal, B: Quite a lot, C: Somewhat, D: Not at all
13. Do you think this type of instruction should be used in more classrooms
    - A: Yes, B: No
Principal Attitudes

Out of five principles surveyed, two responded to the Principal Questionnaire. Such a small number of respondents makes analysis difficult. However, generally speaking, the two principals responded very positively. Among their comments were that student self-esteem has been greatly elevated due to success with Project SEED and that SEED topics directly support MSA skills. In addition they responded that SEED students are actively engaged in Project SEED lessons, that they are extremely proud of what they are learning through the Project SEED Program, that it is evident that the SEED instructors are stretching the students' critical thinking and reasoning skills, and finally that during Project SEED lessons the students are structured, involved, highly motivated, and eagerly waiting to respond to the instructor's questions.

Key Findings:

1. 94.5% of teachers believed that SEED had a least somewhat strengthened their understanding of mathematics.
2. 100% of teachers felt that the teaching methods employed by the Project SEED instructors were either extremely or somewhat effective.
3. All teachers believed that the SEED instruction should be used in more classrooms.
4. Principals were positive about the impact of SEED on student learning and self-esteem.

Question 3: How did participation in SEED impact the percentage of students who score proficient on the Maryland School Assessment?

The Maryland School Assessment is tied specifically to the Maryland Voluntary State Curriculum (VSC) goals and measured according to performance levels of Basic, Proficient, and Advanced. In order to answer the question above, a chi-square analysis was used comparing student change in performance from Basic to Proficient and from Proficient to Advanced between the SEED students and the non-SEED students. For the purposes of this analysis, students were split into groups of students who were in 4th grade and students who were in 5th grade in school year 2007-2008. Performance levels recorded in 2007-2008 were treated as the “pre-test” and performance levels in 2008-2009 were treated as the post-test. Although changes in levels of performance can be in either direction (up or down) for purposes of this analysis, only increased by one level or more are reported. All of the results reported are significant at the p<.000 level.
MSA Reading

Figure 2 shows that Project SEED students are at an advantage for moving from Basic to Proficient on MSA reading. Of non-SEED students in the 4th grade group who scored Basic on the MSA Reading assessment in 2007-2008, 34.7% scored Proficient in 2008-2009. Comparably, in the SEED group 44.7% of the students who scored Basic in 2007-2008 scored Proficient in 2008-2009. None of the Basic scoring students scored Advanced in 2008-2009. Of those who scored Proficient in reading in 2007-2008, 11.7% of the non-SEED group went up to advanced compared to 7.1% of the SEED students.

Of 5th grade students who scored Basic on Reading in 2007-2008, 49.9% of the non-SEED scored proficient in 2008-2009, while 53.3% of SEED students moved from Basic to Proficient in the same time period. In addition, 6.7% of the SEED students moved from Proficient to Advanced in Reading while none of the non-SEED Basic scoring students made such advances. Of those who scored Proficient, 28.4% of the non-SEED students moved to the Advanced level of performance in 2008-2009 while 27.5% of the SEED students moved from Proficient to Advanced.

![Figure 2](image-url)
MSA Mathematics

Figure 3 shows that 5th grade Project SEED students have a significant advantage in moving from Basic to Proficient in mathematics. However, the situation may not be the same for 4th graders. In the 4th grade group, 52.7% of the non-SEED students who scored Basic in Mathematics in 2007-2008 scored at the Proficient level in 2008-2009. Of the SEED students who scored basic, 49.1% scored proficient. A small percentage, 2.7%, of non-SEED, Basic scoring students moved to Advanced in 2008-2009 compared to 1.8% of SEED students in the same time period. These findings are probably an artifact of the content of the Project SEED instruction rather than a function of the *delivery* of the project material. Project SEED students are exposed to highly abstract algebraic concepts in 4th and 5th grades. These concepts are not assessed by the Maryland School Assessment in these grades. Therefore, it is no surprise that students would not perform highly. This simulates the assessment theory of recency. This notion suggests that if students are recently exposed to information, they will do well on any assessment of those topics as opposed to having not been exposed to them in recent time frames. Of students who scored Proficient in 2007-2008, 29.8% of the non-SEED and 30.4% of the SEED students scored Advanced in 2008-2009.

Of 5th grade students who scored Basic in Mathematics in 2007-2008, 19.0% of the non-SEED students moved to Proficient in 2008-2009. Of the SEED students who scored Basic 42.1% moved to Proficient. Of those 5th grade students who scored Proficient in 1007-2008, 2.2% of the non-SEED students moved from Proficient to Advanced in 2008-2009, while 5.8% of the SEED students advanced during that same time period.
Key Findings:

1. Project SEED students are at an advantage for moving from Basic to Proficient on MSA reading in both 4th and 5th grade students. This is probably an effect of the highly verbal nature of the learning process connected to Project SEED instruction.

2. 5th grade Project SEED students have a significant advantage in moving from Basic to Proficient in mathematics.

3. 4th grade Project SEED students show lower growth from Basic to Proficient and the same from Proficient to Advanced in Mathematics. This is probably an effect of the fact that students learn high level algebra concepts which is not tested on the Mathematics MSA in 4th grade.
Discussion and Implications

Answers to Research Questions

Question 1

What was the impact of one semester (14 weeks) of Project SEED instruction during the 2008-2009 school year on student mathematics achievement?

Project SEED was found to have a significant impact on students’ algebraic abilities. When given a test of abstract algebra which included the concepts of group theory and exponents, BCPS students outperformed students in give national comparison groups. It is clear that the instruction that is provided in the 14 week format propels students’ ability to grasp complex algebraic concepts in a short period of time. Given the demographic composition of the schools impacted by the Project SEED study, (relatively high FARMS and non-White student populations) these findings highlight the underlying assumption that all students can learn and are directly in line with the goals of the Blueprint for Progress, particularly Goal 1 which indicates that all students will reach high standards of achievement in core subject areas.

However, when evaluated against the Mathematics MSA in the grade levels where Project SEED students are learning, the performance does not hold up against those students who are not exposed to Project SEED. This is probably an artifact of the fact that students are not exposed in those 14 weeks of SEED instruction to the concepts tested on the MSA. This is a finding that is quite useful because it can help project organizers plan the timing of SEED instruction and make sure that it does not correspond to critical periods when the MSA is being administered. This will give students time to study grade specific mathematics concepts so that they do not veer too far away from the material that they are expected to learn before they leave their given grade level.

Question 2

What was the reaction to the program of Project SEED principals and classroom teachers?

Classroom teachers and principals alike find that the Project SEED instruction is effective. Observations of the SEED classrooms illustrate a dynamic, fast-paced, and engaging learning environment where students and teachers and interested and having fun while mastering material that is extremely difficult to learn. It stands to reason that teachers and administrators would be very supportive of this type of learning environment for students. It has been stated by teachers who were interviewed as well as by the BCPS Mathematics content area staff members that there should be SEED type of instruction in all classrooms. One of the most critical implications of these findings is the exacting nature of the Project SEED instruction in being able to engage students and have them master and outperform on abstract algebraic material. If this could be
replicated throughout the curriculum, students would be at a tremendous advantage in their ability to achieve at high levels in any core subject area.

**Question 3**

*How did participation in Project SEED impact the students’ level of performance on the Maryland School Assessment?*

The data suggested that Project SEED students were at an advantage for moving from Basic to Proficient on 4th and 5th grade MSA Reading. It was also found that 5th grade SEED students were more likely to move from Basic to Proficient in MSA Mathematics. However, project SEED students were less likely to move from Basic to Proficient on the 4th grade MSA Mathematics assessment.

These findings are important and suggest that the extensive Algebra content that students are exposed to during the SEED experience might have a benefit above and beyond that of producing high achieving 4th and 5th graders in algebra. The project seems to have impacted students’ language arts abilities as well. Observations of SEED classrooms find students being exposed to sophisticated vocabulary and definitions of mathematical and scientific concepts. In addition, students are exposed to way of solving problems which involve deconstructing equations and categorizing concepts, which no doubt collaborate in developing students’ critical and abstract thinking abilities. This is a key in promoting high achievement in language arts.

However, why did students not do as well on the MSA Mathematics component? It has already been suggested that this finding is quite possibly an artifact of the recency effect. Students who have been exposed to highly sophisticated, sometimes college level, algebraic concepts for 14 weeks straight, will probably not be grounded in the standard 4th and 5th grade math that is tested on the MSA. It is highly suggested that planners take into account the timing of the MSA assessments in order to give student ample time to re-familiarize themselves with the appropriate concepts that are required of them in the grade levels that they are being tested on.

**Future Directions**

It has already been suggested that Project SEED has benefitted the students that participated. Future directions have also been suggested. It will be important as the project moves forward to continue to develop teachers professionally and possibly expand the scope of the projects to include more classrooms and/or more content areas. Also, it is extremely important to keep in mind the assessment responsibilities that schools have in relation to the MSA and time the 14 week sessions in accordance with not disturbing the natural progression of the curriculum as students prepare for grade level Mathematics assessments. Finally, a focus of future evaluation efforts may benefit from looking into the seemingly strong impact of the Project SEED approach on the language arts development of elementary school children.
PROJECT SEED:  
THE PROGRAM 
AND THE EVALUATION 

RESULTS FOR 2008-2009

Departments of STEM and 
Research, Accountability, 
and Assessment
THIS PRESENTATION INCLUDES

- Explanation of Project SEED
- Findings of an Evaluation
- Next Steps for Expansion of Project SEED
WHAT IS PROJECT SEED?

- **Nationwide Program**
  - Mathematicians teach advanced mathematical concepts to elementary classes
  - Supplemental to regular curriculum - 4 periods per week

- **Innovative Instructional Approach**
  - Socratic method with open-ended dialogue
  - Reinforces critical thinking and computational skills

- **Teacher Professional Development**
  - Classroom teacher observes instruction.
  - Debriefing meetings occur between teacher and Project SEED instructor.
  - Teacher attends several workshops throughout the year.
MODE OF DELIVERY

- Two or three week demonstration classes
  - Takes the place of regular mathematics classes over four days

- Fourteen week standard term classes
  - Supplemental to the mathematics classes four days per week
DEMONSTRATION SCHOOLS 2003-2010

- Johnnycake ES
- Middlesex ES
- Hawthorne ES
- Stemmers Run MS
- Baltimore Highlands ES
- Riverview ES
- Halstead Academy
- Villa Cresta ES
- Bedford ES
- Milbrook ES
- Scotts Branch ES
- Mars Estates ES
- Deep Creek ES
- Hebbville ES
- Powhatan ES
- Featherbed Lane ES
- Woodmoor ES
- Glenmar ES
- Perry Hall ES
- Jacksonville ES
- Carroll Manor ES
- Pinewood ES
- Carney ES
- Kingsville ES
- Vincent Farm ES
STANDARD TERM SCHOOLS 2007-2010

- Halstead Academy
- Milbrook Elementary
- Powhatan Elementary
- Woodmoor Elementary
- Featherbed Lane Elementary
- Hawthorne Elementary
- Pleasant Plains Elementary
GOALS OF THE EVALUATION

- To evaluate the impact of Project SEED instruction on 4th and 5th grade student mathematics achievement at BCPS
- To assess the impact of Project SEED on teacher attitudes toward mathematics instruction
RESEARCH QUESTIONS

1. What was the impact of one semester of Project SEED instruction during the 2008-2009 school year on student mathematics achievement?

2. What was the reaction to the program of Project SEED principals and classroom teachers?

3. How did participation in Project SEED impact the students’ level of performance on the Maryland School Assessment?
MEASURES

- Independent test of Abstract Algebra
- Maryland School Assessment - Mathematics
- Teacher Survey
- Principal Survey
DESIGN

- Project SEED schools compared to demographically matched non-SEED schools
- Independent assessment of abstract algebra
- Statistical analyses with MSA scale scores and MSA proficiency levels
RESULTS
Project SEED students scored significantly higher than a national comparison group on an independent test of Abstract Algebra.

Students’ prior year score on MSA Reading and Math was a positive predictor of students’ current year MSA Reading and Mathematics score.

Project SEED participation was a negative predictor of Mathematics in both 4th and 5th grades.

- Probably the effect of instructional recency
Teachers believe that Project SEED strengthened their understanding of mathematics.

Teachers felt that the SEED teaching methods were effective.

Teachers believed that the SEED instructional methods should be employed in more classrooms.

Principals were positive about the impact of SEED on student learning and self-esteem.
Project SEED students are more likely to move from Basic to Proficient on the MSA Reading in 4th and 5th grades than non-SEED students.

Project SEED students in 5th grade are significantly more likely to move from Basic to Proficient in mathematics than non-SEED 5th grade students.
Percent of Students Moving Up One Performance Level on MSA Mathematics

4th Grade
- Basic to Proficient: Non-SEED 52.7%, SEED 49.1%
- Proficient to Advanced: Non-SEED 29.8%, SEED 30.4%

5th Grade
- Basic to Proficient: Non-SEED 19.0%, SEED 42.1%
- Proficient to Advanced: Non-SEED 2.2%, SEED 5.8%
DISCUSSION AND IMPLICATIONS
Supports Goal 1 of the Blueprint for Progress, which indicates that all students will reach high standards of achievement in core subject areas.

Demystifies theoretical mathematics by exposing students to more advanced concepts at an earlier age.
**PROJECT SEED NOT RELATED TO INCREASED MSA SCALE SCORES.**

- Possibly related to the timing of the intervention to the MSA assessment cycle.
- Further study needed on whether classroom teachers are able to transfer Project SEED pedagogy to their own instruction.
Project SEED instruction engages students in mastering abstract algebraic material.

Teachers recommend replicating the SEED instructional methods throughout the curriculum.
Impact on MSA Reading suggests a parallel benefit of increasing students’ critical language abilities.

Implication is that SEED enhances critical thinking and problem solving abilities.
**NEXT STEPS**

- Focus group with principals and teachers to draft recommendations on how SEED can be expanded to more schools and to benefit more students.