

Teaching Beyond the Test

Using Science To Support School-Wide
Improvement

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Today We Will Answer Two Essential Questions...

- How can science instruction be used to support school-wide improvement in reading, writing, and math?
- How does science instruction fit in with other school-wide initiatives to improve reading and writing?



Science Engages Students and Teaches Transferable Skills

- By the end of this session, participants will be able to:
 - Justify how science inquiry enriches and extends critical thinking skills in reading/language arts and math content areas
 - Describe how science inquiry can be used to overcome learning barriers



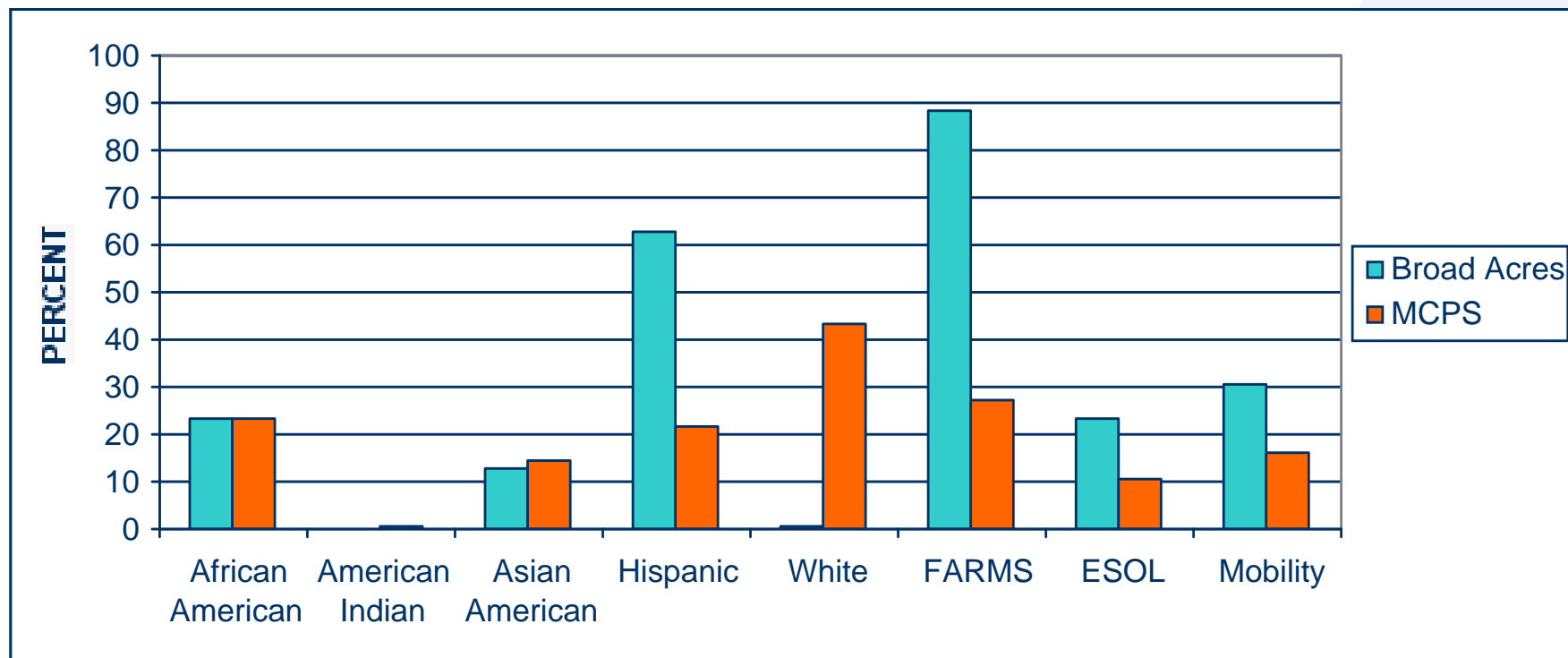
A School in Need of Improvement



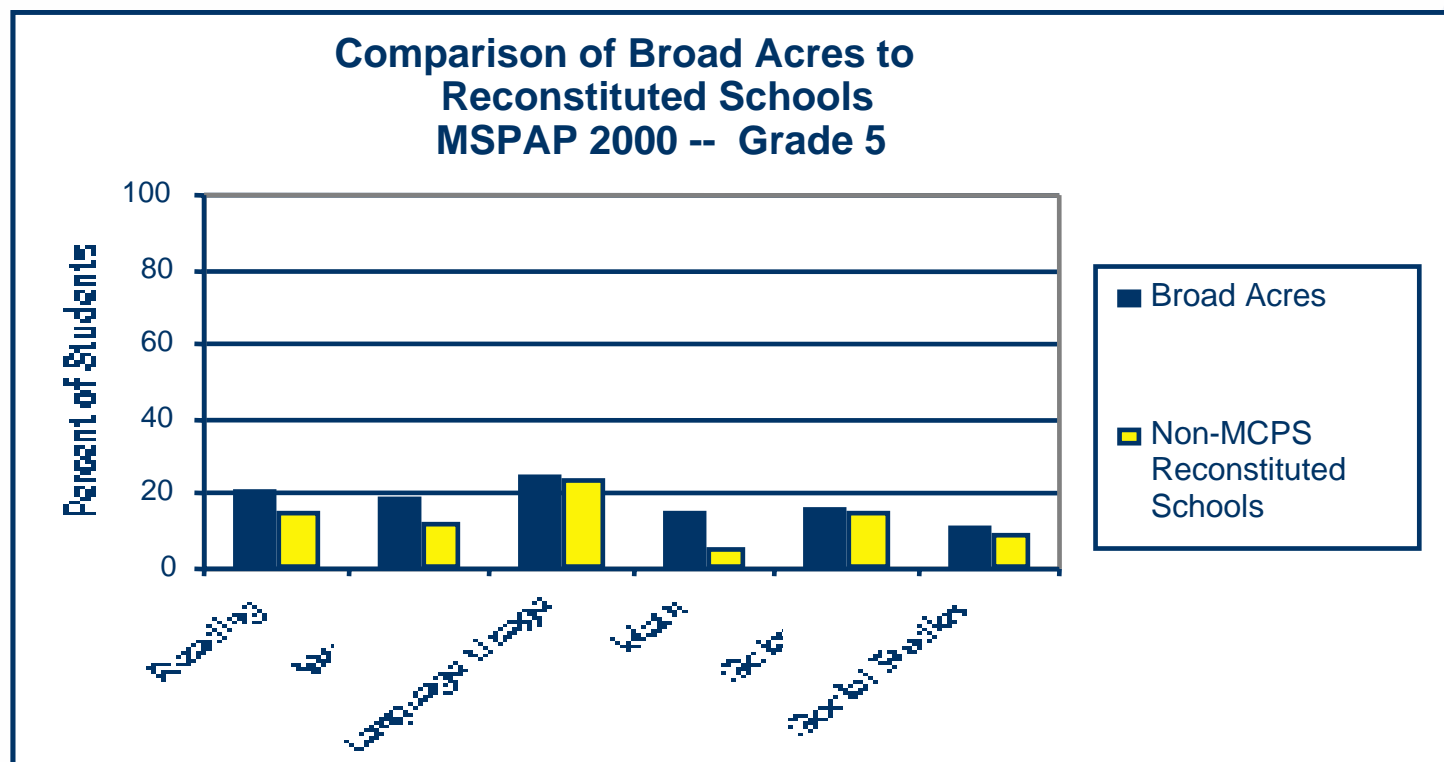
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Montgomery County, Maryland, Is a Demographically Diverse Community

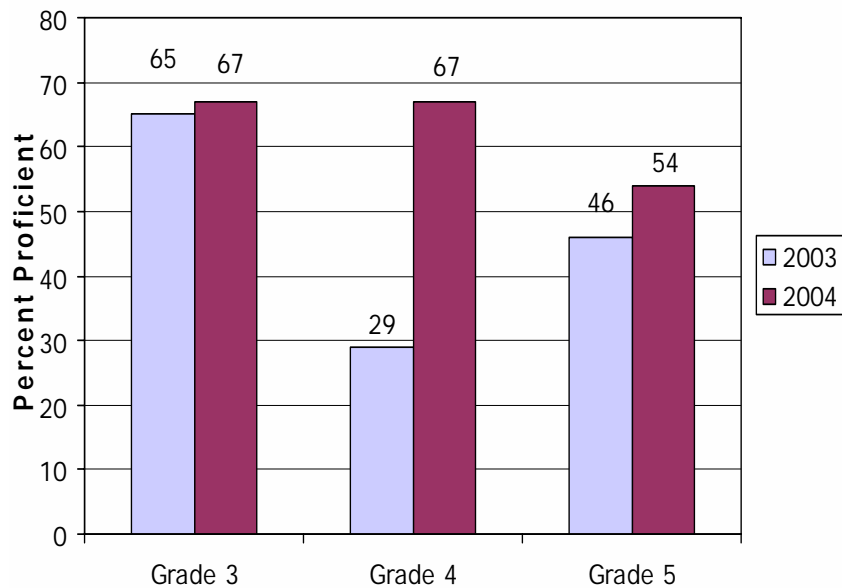


Before: A School in Need of Improvement

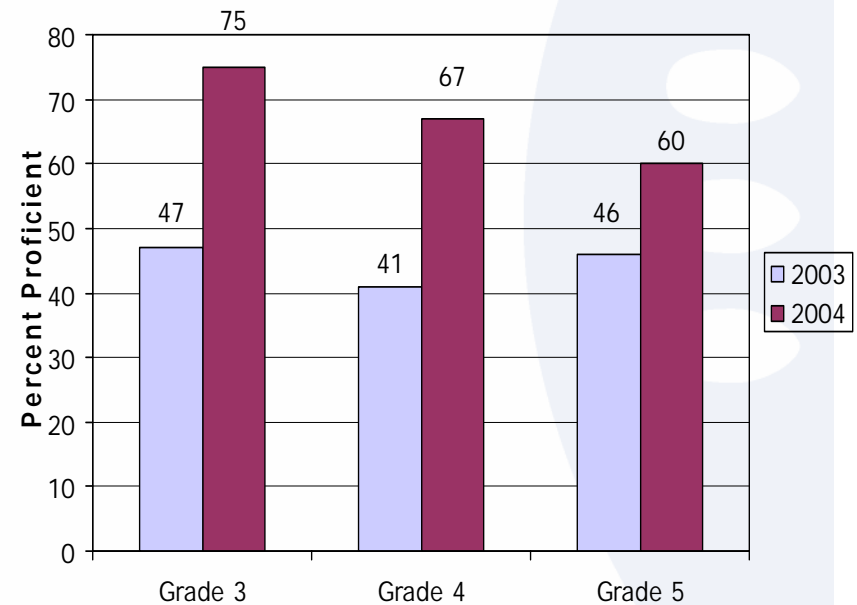


After: Dramatic Progress

Math 2003 - 2004



Reading 2003 - 2004



What Changed?

- Coordinated effort and belief system for high expectations among staff – across all grade levels and content areas
- Adequate support structures for teachers (e.g., specific research-based professional development, grade and vertical curriculum planning time, tuning protocols, study groups)
- Consistency in curriculum, instruction, and assessment



Science – An Element of Success

- Achievement of science objectives builds thinking skills applicable to other content areas
- Years 1 and 2
 - Science is mandated as part of the school improvement plan for reading goal
- Year 3
 - Science is expanded to the school improvement plan for math goal



Science Process Standards Are the Application of Reading, Writing, and Math

Science Standards –

- Access and process information from readings
- Analyze and develop well-designed investigations (predictions, conclusions, etc)
- Collect, organize, and interpret data
- Analyze data for trends
- Observe patterns
- Communicate effectively orally and in writing



Empowering Teachers



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To Begin, We Empower Teachers with Science Content Knowledge

The Well-Designed Investigation

- Testable question
- Well-designed procedures
- Hypothesis
- Conclusion
- Communication
- Extension



Science Inquiry Starts with Defining a Testable Question

Activity 1 -- It's all about the questions:

- **Research questions** – focus the inquiry
- **Observation questions** – answered through observations
- **Testable questions** – answered through an investigation (variable manipulated)



A Well-Designed Investigation Promotes Critical Thinking Skills...

Activity 2 – You be the investigator:

- Use the materials in the plastic bag at your table to create a testable question
- Jot down how you would design a well-designed investigation to answer your question
- Discuss the skills required to successfully complete the exercise



...Which Enhances Student Application of the 3 R's

- Reading – accessing and processing information from text or observations
- Writing – predicting, procedures, conclusions
- Math – data collection and interpretation, measurement, identifying trends/patterns



Sample Science / Writing Lesson

- Activity 3 – Magnet Investigation
 - Engage—How many paper clips adhere to one magnet?
 - Explain—Predict how many paper clips will adhere to two magnets?
 - Explore—Investigate
 - Extend—Does the number of magnets affect the number of paper clips that adhere?
 - Evaluate—How many paper clips adhere to two magnet? Was prediction confirmed?



What's Mastery?

- Predictions

- **Mastery Level:** State expected outcomes and use prior knowledge gained from readings, investigations, and/or observations to justify prediction

- Conclusions

- **Mastery Level:** State results of investigation in terms of an answer to the testable question and relate results to prediction as confirmation or rejection

- *Writing* – clear, follows conventions, uses science vocabulary
- *Math* – identifies mathematical relation between number and size of magnets to number of paper clips



Science Content and Process are Inseparable

- Plant growth and development unit standards:
 - Cite evidence to support the importance of food, water, and air in the structure and function of living things
 - Cite evidence that organisms can survive in environments in which their needs (e.g., food, water, and habitat) can be met
 - Describe examples that show that offspring are like one another
 - Identify the interactions between organisms and the environment



Science Content is Attained Through Process

- **Think/pair/share:** What's the standard for each of these plant growth and development investigations?
 1. How does using cactus soil affect the growth and development of *Brassica Rapa* plants?
 2. Does prevention of pollination affect the seed yield of *Brassica Rapa*?
 3. Do offspring *Brassica Rapa* seeds grow and develop the same as their parent plant?
 4. How does increasing or decreasing the amount of fertilizer affect the growth and development of *Brassica Rapa* plants?



Success Story



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Student Achievement Through the Application of Science

- MCPS sponsors an annual student Science Inquiry Conference
- Students have to:
 - Apply to present
 - Prepare a presentation – PowerPoint, overhead, demonstration, poster session
 - Present to other elementary or middle school students
 - Answer peer questions



Case Study – Students Overcoming Challenges

- Brenden
 - History of poor academic achievement
 - Difficulty attending in class
 - Failure to complete assignments
 - Poor writing skills
- Viet
 - Non-English-speaking household
 - In U.S. school 18 months
 - Eager to learn but not able to communicate
 - Gifted in math



Case Study – Evidence of Success

- Both students --
 - Prepared own PowerPoint presentation
 - Gave presentation at conference of 20 peers
- Brenden
 - Engaged in work, exhibited a desire to be successful by completing his work, sought help, showed pride
- Viet
 - Well-written and communicated presentation



Science Is an Effective Way To Teach Communication and Math

- Reading and math skills
 - Accessing, processing, and summarizing information
 - Creating nonlinguistic representations
 - Generating and writing predictions/hypotheses
 - Developing and writing well-designed procedures
 - Organizing and recording data
 - Generalizing, inferring, and drawing conclusions
- Engaging to all students, including students without a history of success



Science Connects

- Concluding Task: Sort the skill words/phrases in the word bank into three categories – Reading/Language Arts, Science, and Math
 - *What do you notice?*



Teaching Science Is Teaching Beyond the Test

- Current standardized tests focus on reading and math
- Teaching science content through the inquiry standards not only imparts critical thinking skills, but it reinforces and applies communication and math skills that sometimes are taught as isolated concepts

– This is teaching beyond the test



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Implementation Activity

The lesson must:

- provide for students to either read to be informed for the purpose of making a prediction and/or write a prediction, procedures, or conclusion
- have students collecting, organizing, and displaying data in table or graph
- include an assessment with scoring tool to determine student performance level of the embedded literacy and math skills

