

**MONTGOMERY COUNTY  
INTERMEDIATE UNIT**



**REPORT TO THE SCHOOL DISTRICT OF  
UPPER MORELAND TOWNSHIP  
ON THE FINDINGS OF  
THE K-12 SCIENCE  
PROGRAM EVALUATION  
MARCH 26-28, 2007**

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**K-12 SCIENCE CURRICULUM EVALUATION  
FOR THE SCHOOL DISTRICT OF UPPER MORELAND TOWNSHIP**

**INTRODUCTION**

This document is a report of the findings of the evaluation of the K-12 science program of the School District of Upper Moreland Township located in Montgomery County, Pennsylvania. The program evaluation was conducted during the period of March 26-28, 2007

**BACKGROUND**

The Montgomery County Intermediate Unit Curriculum Evaluation Process is designed to assess the quality and effectiveness of curricula, and generate information to assist with decision making as a means of providing for continuous improvement of the educational program. The evaluation examines questions identified by the district in terms of the written curriculum, the taught curriculum, the assessed curriculum, and the processes and structures that have been established in the district to manage curriculum.

Reviews of programs take place through the active participation of school districts in Montgomery County that support the process by providing release time for their staff to participate. Each school district was asked to recommend individuals with outstanding background in the area of science education, curriculum development, or administration. Names were forwarded to Jenny Lehman, Director of Education for the School District of Upper Moreland Township.

This evaluation of the School District of Upper Moreland Township's K-12 Science Program was requested by the District's administration as part of an ongoing process for curriculum management. Prior to the visit by the Evaluation Committee, discussion with the administration was conducted to refine the specific areas on which the evaluation would focus.

Members of the Program Evaluation Committee were:

Mr. Chad Antonio	Pottstown School District
Dr. Grace Cisek	Perkiomen Valley School District
Ms. Jennifer Derstine	Perkiomen Valley School District
Mr. Jeff Devlin	Pottsgrove School District
Ms. Roberta Jacoby	Cheltenham School District
Dr. Reed Lindley	Pottstown School District
Dr. Robert Shields*	Montgomery County Intermediate Unit
Mr. Ken Trautwein	Hatboro-Horsham

\* Chair

### **Methodology**

The School District of Upper Moreland Township identified specific questions that they wished to explore. Every effort was made to ensure that the discussion and questions emanating from the staff were integral to the program evaluation process. It is through these questions that the evaluation was conducted.

Members of the Program Evaluation Committee were oriented to the program evaluation process and to the School District of Upper Moreland Township on March 21, 2007. On March 26, 27, and 28, 2007, the members of the team began the actual review process which involved the examination of key district curriculum related documents, interviews of key individuals in the school community, and the observation of classroom instruction.

### **Data Sources for the Program Evaluation**

#### **Documents**

These sources included written board policies, administrative regulations, curriculum, memoranda, state reports, and other documents related to the focus of the program evaluation.

#### **Interviews**

Interviews of elementary classroom teachers, building administrators, middle school and high school science teachers were conducted by the Committee. Also interviewed were the Superintendent, Director of Education, the Supervisor of Curriculum and Instruction, staff members, and President of the Board of School Directors.

## **Classroom Observation**

The observations were not of a formal nature, and no specific protocol for the observation was used other than to direct observers to use the observation as a way of verifying data obtained during the interview.

## **Focus of the Evaluation**

Specific questions that the District requested the external team to examine were:

1. Is there a clear, comprehensive rationale and vision for the K-12 science program?
2. To what extent is the curriculum aligned to State Standards?
3. How effectively are best practices being used to implement instruction in science?
4. How are assessments used to assess student achievement and modify instruction/curriculum?
5. To what extent do the current materials, resources and technology meet the needs of the science curriculum?
6. How effectively are safety practices being implemented in science classrooms?
7. To what extent are planning and staff development opportunities available and used to keep teachers and administrators current with best practices research?
8. How is information regarding the science program communicated to parents and the community?

## **Analysis of Data**

The Committee examined data that was collected and summarized the findings in terms of District strengths, needs, and recommendations. This was done for the District as a whole, and by organizational level in the District. This report first presents the findings relative to the questions posed, and then presents the findings of the Committee for the District and each organizational level in terms of strengths, needs, and recommendations for addressing the identified needs. It should be emphasized that while the scope of this evaluation was limited to the area of K-12 science, the systemic implications of the recommendations must be taken into account when considering their implementation.

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**ANSWERS TO QUESTIONS RAISED BY THE  
SCHOOL DISTRICT OF UPPER MORELAND TOWNSHIP**

**1. Is there a clear, comprehensive rationale and vision for the K-12 science program?**

There is a clear, comprehensive rationale and vision for the K-12 science program. The Framework Committee for Science has developed the following K-12 Science Mission statement:

“Our mission in the Upper Moreland Township School District is to create a community of learners able to use scientific process through inquiry, observation, classification, experimentation, analysis, synthesis and application to serve as a foundation for life-long scientific discovery.”

Interviews with teachers and administrators indicate that there is an understanding of the purpose and vision for the science program in the district. Interviewees explained that the purpose was to have students think like scientists. The interviewees clearly articulated that the intent of the program design is to promote inquiry learning.

**2. To what extent is the curriculum aligned to State Standards?**

The review of the K-12 science program is part of the fourth phase of the curriculum cycle that the District has established for each curricular area and has a written scope and sequence for the K-12 science curriculum. There are also written planned courses that reflect District policy for the construction of planned courses.

The planned courses list standards and require the reader to refer to the scope and sequence document. The scope and sequence documents are organized by standard, and list the benchmarks to be attained by students, level of mastery, pacing, best practice strategies and assessments. Although the District has begun to align with PSSA Assessment Anchors and Eligible Content the alignment has not been completed.

**Recommendations**

- a. The planned courses do not reflect alignment with PSSA Assessment Anchors and Eligible Content. Preliminary work has been done in this area. It is recommend that the scope & sequence document be modified to include Chapter 4 prerequisites for planned instruction, Assessment Anchors and Eligible Content; linkages to the kit objectives.
- b. The various science curricula must be examined against the district vision for science and how the district will assess student proficiency relative to those expectations. Included in this is an examination of the degree to which the curriculum assesses the Eligible Content identified for the Pennsylvania

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System of School Assessment (PSSA). This will insure that assessment is driving the instruction and that there is alignment with what is assessed and what is taught.

- c. Examine the structures used to monitor the delivery of the written curriculum.

**3. How effectively are best practices being used to implement instruction in science?**

The School District's stated mission calls for "learners able to use scientific process through inquiry, observation, classification, experimentation, analysis, synthesis and application to serve as a foundation for life-long scientific discovery." The National Science Education Standards (1996) emphasize that teaching practices need to be consistent with the goals and framework of the district. Best practices identified in the Standards that align with the district vision include:

- Tailoring instruction to individual student's interests, experiences, and needs
- Focusing on student understanding and use of scientific knowledge, ideas and the use of inquiry processes
- Guiding students in active and extended scientific inquiry
- Providing opportunities for scientific discussion and debate among students
- Continually assessing student understanding
- Supporting a classroom community with cooperation, shared responsibility and respect

The committee found that teachers at every level are using best practices; however there is a need for these practices to be used consistently by all teachers at every level.

At the K-5 level, teachers were observed teaching science through the use of hands-on materials, beginning lessons with "essential questions", and having students work cooperatively on a variety of explorations. In general, instruction at this level was considered one of the strengths of the program. Observers noted that they worked to integrate science into other curricular areas. At grades 6-8 observers noted an inquiry-based, hands-on instructional emphasis. Observers at the high school noted that there was a need to increase the amount of student-centered instruction.

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**Recommendations**

- a. Provide for consistent use of differentiated instruction across the district. In particular, discuss the discrepancy between inquiry and coverage as students move from the K-8 level to the 9-12 level.
- b. At the K-5 level there is the need to look at how science is integrated with other subject areas as instructional time is an issue. Even as the District investigates this issue it is important to emphasize the need to maintain collaborative time for planning, data analysis, etc.
- c. Revise the District system for evaluation and supervision to ensure the fidelity in the delivery of the planned instructional program.

**4. How are assessments used to assess student achievement and modify instruction/curriculum?**

The National Science Education Standards call for teachers of science to engage in ongoing assessment of their teaching and of student learning. This includes the use of multiple methods and systematic gathering of data about student understanding and ability; as well as analyzing assessment data to guide teaching.

Based on comments made during interviews and observations the committee believes that this is an area to strengthen across the K-12 science program. It should be noted that assessment does occur across the district. There is a need for the assessments used to be consistent with the vision espoused for science education and need to look at modification of instruction based on the assessments. There is also a need for consistency, for example, observers noted that assessment at the K-5 level was more summative and that there is a need for more formative assessment. Middle school observers noted a focus on formative assessment. At the high school level the dominant forms of assessment are unit tests, quizzes and homework. Teachers use different midterm and final examinations, although common questions are used. Data from the tests are not used systematically.

The reporting of student achievement in science is not aligned to standards. Report cards at the K-5 level report student progress in terms of understanding and applying vocabulary and key concepts; demonstrating appropriate and safe use of scientific equipment; demonstrating skills of observation; and participating in hands-on investigation.

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**Recommendations**

To strengthen assessment practices relative to science instruction the committee recommends the following:

- a. Ensure that the written science curricula are based on clear identification of what students should know and be able to do relative to science, and determine what performances would indicate understanding or proficiency.
- b. Provide professional development on the use of multiple methods of assessing student understanding in the area of science. This should include backward design of lessons from the essential questions identified in the curricula, differentiation of assessment tasks, understanding of the strengths and weaknesses of the various types of assessment that support a hands-on, inquiry-based approach to teaching science. Also included should be professional development on guiding students in self-assessment. Administrators should also receive professional development on the assessment practices that they should be seeing and reinforcing in science classrooms.
- c. Replicate the work that the district has done in creating common assessments in reading and mathematics by developing and implementing K-12 benchmarks and common assessments in science. These should be aligned with the Pennsylvania Assessment Anchors and Eligible Content for Science.
- d. Use structures at the building and district level to provide for the analysis of student data to guide teaching. See the recommendations for small learning communities found in *Results Now* (Schmoker, 2006). These structures should also be used to examine how student progress is reported and what changes need to be made to accurately reflect what students know and are able to do.
- e. Revise student report cards to reflect what students know and are able to do relative to the expectations of the curriculum.

**5. To what extent do the current materials, resources and technology meet the needs of the science curriculum?**

A district Teacher's Technology Resource Guide exists. Teachers at the K-5 level were enthusiastic about the use of United Streaming video clips, and the FOSS website. The document lists curriculum support software. At the Primary and Intermediate School, Scholastic's Magic School Bus Series is identified along with the Weather Bug Achieve Program. At the High School, Science Workshop (PASCO) is available, as is Graphical Analysis for Windows, and Data Studio, Google Earth, and YouTube. Chemistry books are dated 1996, there are no dissections taking place except in Anatomy and Physiology.

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**6. How effectively are safety practices being implemented in science classrooms?**

The *National Science Education Standards* emphasize that safety is a fundamental concern in all experimental science. The Committee found through observation and interviews that safety is a priority and that safety practices are implemented on a consistent basis across the district. An example noted at the elementary level was that all students were wearing safety glasses during lab exercises. At the K-8 level a portfolio regarding science safety is given to each teacher. Every teacher is expected to review and return the *Safety in the Elementary Science Classroom* flipchart and the “Science Safety Eyewear Inventory” sheet at the end of the year. Safety oversight at the High School is handled through the Framework Leader.

**7. To what extent are planning and staff development opportunities available and used to keep teachers and administrators current with best practices research?**

Based on information obtained in interviews and the examination of professional development records, the Committee found that the District has provided opportunities for professional development and growth in science. The District’s Framework for Continuous Improvement provides an excellent structure for linking professional development, curriculum, instruction, and assessment.

The examination of the plans for implementation of the program and the implementation of the program in other content areas, i.e. literacy, indicate that the district has established the infrastructure to increase professional development opportunities in science. Opportunities for horizontal and vertical sharing of best practices are present via the Science Curriculum Committee. Meetings are scheduled at the elementary level. Time for department meetings at the building level is allocated during district staff development days.

Framework leaders receive training and are expected to train staff. Professional development activities for science are offered during District professional development days. Examination of professional development records show that science staff participated in the following science related activities and programs over the past five years:

- Framework committee workshop
- Differentiated Instruction
- Science committee meetings
- Assessment
- Technology
- FOSS Science Workshops
- NSTA Convention (Framework Leaders)
- Inquiry Workshop (Internal)
- Safety K-12

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**Recommendations**

- a. Revise the district evaluation and supervision system to ensure fidelity in the implementation of the curriculum and to help coordinate instruction and professional development. Specific elements to consider in a differentiated supervision model would be the existing study group model, peer coaching, and action research.
- b. Provide additional time for sustained professional development in science. Evaluate the use of time to provide professional development at all levels, e.g. morning meetings etc. Ensure that all teachers (not just framework teachers) receive the training especially in Inquiry Learning. There appears to be a need for more training for academic and college prep teachers. Bring in speakers on in-service days.
- c. Continue to build on the use of internal resources. Internal trainers should model the use of inquiry in the professional development of teachers. At the same time provide additional opportunities for teachers, in addition to Framework Leaders, to participate in out of district professional development in the area of science.
- d. In addition to science-specific offerings, continue to train in Tomlinson's Differentiated Instruction model at all levels.

**8. How is information regarding the science program communicated to parents and the community?**

Information regarding the science program is communicated to parents and the community through a variety of District publications. These include "The Journal" which is the community newsletter of the district and is used to provide information to parents and the community about district events and activities. This includes curricular changes. The December 2003 edition featured information on the then piloted science program, as well as the "Framework for Continuous Improvement."

Other means of communicating information about the science program include teacher newsletters; distribution of publications from the Full Option Science System (FOSS); and presentations at open houses, and school board meetings. The District website provides information regarding the science curriculum, and related activities. The "Star Portal" is another vehicle that can be used to provide information directly to parents at the high school and middle school levels. It is a secure individually personalized web-based student information service. One of the most powerful vehicles for communicating about the science program at the K-5 level has been the enthusiasm of the students. This was confirmed through informal discussions with students and in interviews with staff.

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**Recommendations**

*EDThoughts: What we know about science teaching and learning* points out the importance of teachers and administrators communicating the goals of the science program to parents and the community, and notes that such communication is critical to building partnerships with parents. The Committee commends the District's efforts and recommends that they continue. One area to continue is the use of the District web site and the Star Portal to communicate with parents and the community.

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**OVERALL STRENGTHS, NEEDS, AND RECOMMENDATIONS**

**Strengths**

1. The District “Framework for Continuous Improvement” provides for a systemic approach to designing and implementing the K-12 science curriculum.
2. Safety in teaching science is a priority in the District.
3. The District staff exhibits professionalism.
4. A standards-based curriculum is in place.
5. The District is committed to providing quality facilities that support its instructional goals.

**Needs**

1. To complete the alignment of PSSA Assessment Anchors and Eligible Content to district planned courses/scope and sequence documents.
2. Expand involvement by expanding communication in the Framework process to staff outside of the Framework Committee.
3. To provide structures for collaboration by all teachers; focusing on best practices in instruction and assessment.
4. To ensure that formative and summative assessment practices drive instruction.
5. To ensure the use of best practices in science instruction.
6. To revise the District’s system for evaluation and supervision.

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**Recommendations**

**1. Complete the alignment of PSSA Assessment Anchors and Eligible Content to district planned courses/scope and sequence documents.**

As was noted in the previous section, planned courses do not reflect alignment with PSSA Assessment Anchors and Eligible Content. Preliminary work has been done in this area. It is recommend that scope & sequence document be modified to include Chapter 4 prerequisites for planned instruction, Assessment Anchors and Eligible Content; linkages to the kit objectives.

**2. Expand leadership by expanding participation in the Framework process to staff outside of the Frameworks Committee.**

During interviews members of the Committee found that a number of staff wished to be included in the decision making process. This is an area that warrants further discussion across the district regarding the need to gather additional input from staff.

**3. Provide structures for collaboration by all teachers; focusing on best practices in instruction and assessment.**

The Framework for Continuous Improvement designates time for K-12 Science Committee meetings, K-5 Science Committee meetings, 6-8 Science Committee Meetings, and 9-12 science committee meetings. District science teachers meet collectively on designated professional development days. Although the work of the Framework Committee is a strength in the District, the Committee recommends that the District explore ways to provide for increased grade level participation and collaboration that is inclusive of all teachers of science. Such meetings would be used to focus on discussing best practices in science instruction and assessment.

Mike Schmoker in *Results Now* (2006) offers a variety of suggestions and structures for the establishment of small learning communities. The HOPE Foundation is another source of information and services to assist districts in the development of professional learning communities. Also see *Failure is Not an Option: Six Principles that Guide Student Achievement in High Performing Schools* by Alan Blankstein.

**4. Ensure that formative and summative assessment practices drive instruction.**

See the recommendations on page 9 relative to assessment.

**5. Ensure the use of best practices in science instruction across all grades**

One of the findings in answering the District-wide question regarding the use of best practices in instruction was that while the committee found that teachers at every level are using best practices; there is a need for these practices to be used consistently by all teachers at every level. This would include the continuation of professional development in differentiated instruction specific to teaching science at

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each organizational level of the district. Focused training on teaching inquiry and hands-on science should be provided. Revise the district evaluation and supervision system to and ensure fidelity in the implementation of the curriculum and to coordinate instruction and professional development.

**6. To revise the District's system for evaluation and supervision.**

This finding and recommendation echoed a theme from the finding of previous external evaluations. Beyond the recognized need for development of the curriculum is the need to review the structures to insure its delivery. The District's system for evaluation and supervision must be used as a vehicle to link the curriculum to professional practice, and professional development.

In educational jargon, the term evaluation refers to administrative oversight to insure that the teaching of the content is being done in a competent manner that is consistent with best practice and with the mission, policies, and procedures of the organization. The term "supervision" refers to a variety of practices that foster professional growth. In this context supervision practices are non-evaluative.

The use of a differentiated framework which separates evaluation from supervision will provide for consistency in delivery of the curriculum, improvement of instruction. It is critical to note that this recommendation affects all instructional areas and must involve all facets of the school system.

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**ELEMENTARY SCHOOLS**

**STRENGTHS**

1. The design of the components of the K-5 program, and instructional practices used by staff is a strength of the science program.
2. The staff is professional, well prepared, flexible, and highly motivated to use the K-5 science program.
3. Students were enthusiastic and motivated to learn about science.
4. The science scope and sequence is well organized and aligned to State Academic Standards.
5. The district provided quality professional development in implementing the science program.
6. Materials to support integration of the reading and language arts program with the science program are available in the classroom and library.
7. The staff and students are safety conscious.
8. The schools have excellent facilities to support science instruction.
9. The availability of instructional assistance with the maintenance of the science materials is a strength of the science program.
10. The program is well received by enthusiastic students who tell parents that science is the subject that they like the best.

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**NEEDS**

1. To provide additional structures for collaboration by all teachers to focus on discussion regarding best practices and assessment.
2. To continue to provide training and support for integration of technology into the science program.
3. To provide for consistency in evaluating student learning through the use of common assessments.
4. To provide for greater accountability for rigor across grade levels.
5. To provide for greater differentiation in instruction.
6. To increase the use of community resources to enhance the science curriculum.

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**RECOMMENDATIONS**

**1. Provide additional structures for collaboration by all teachers to focus on discussion regarding best practices and assessment.**

This is a district wide issue. As is noted in the first section of this report, the Committee recommends that the District explore ways to provide for increased grade level participation and collaboration that is inclusive of all teachers of science.

**2. Continue training and support for integration of technology into the science program.**

Increased professional development should be provided for teachers on the integration of technology into their instruction. Teachers also liked to use the United Streaming video service that is available to teachers. Professional development in using this service is available through the Montgomery County Intermediate Unit and can be tailored to meet specific instructional needs.

**3. Provide for consistency in evaluating student learning through the use of common assessments.**

See the recommendations on page 9. In interviews teachers at this level noted that this was one of the most difficult areas to address in the program. The recommendations in the previous section lists specific steps in the process including a review of what students are expected to know and do, determining what proficiency is relative to those expectations. The District has great expertise in this area and should replicate its previous work in creating common assessments in reading and mathematics by developing and implementing K-12 benchmarks and common assessments in science.

**4. Provide for greater accountability for rigor across grade levels**

- In the process of revising the curriculum, evaluate each unit to ensure that the “essential questions” are truly essential- ensure that the activity will lead to answering the essential question.
- Ensure that all teachers continue to probe and ask higher order questions.
- Provide collaborative time to increase curricular integration; especially in the area of mathematics.
- Ensure that staff is familiar with Webb’s Depth of Knowledge to help ensure the rigor of assessments.
- With the necessary emphasis on reading, math, related arts, etc. at times the time allotted for science is minimal. Schools may wish to consider a schedule that would provide fewer days for science, but a commitment to one hour within that scheduled time on a consistent basis.

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**5. Provide for greater differentiation in instruction**

Please see the first section in regards to increasing the skills of staff in the area of differentiated instruction. The Committee recommends that the district continue to push in for science with gifted students.

**6. Increase the use of community resources to enhance the science curriculum**

National Science Education Standards emphasizes the importance of using resources outside of the classroom and school to teach science. While this is currently in place at the K-5 level, the Committee recommends that the various field trips and activities with community resources be aligned with the curriculum in the proper grade levels to match standards and curriculum. The establishment of science-related business-education partnerships is encouraged.

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**MIDDLE SCHOOL**

**STRENGTHS**

1. There is excellent collaboration between staff within the grade levels in regards to inclusion, best practices, and the use of common assessments.
2. All observed teachers emphasized proper safety procedures including documentation; handling and storage of materials and equipment; and the posting of safety information in each room.
3. All observed teachers referred to the “Big 6” framework, showing good integration within the subjects and consistency of instruction.
4. Excellent cooperation between learning support teachers and regular education teachers was observed.
5. Students exhibit high levels of cooperation and respect.
6. Administration and teaching staff show mutual respect and cooperation; this has a positive effect on motivation.

**NEEDS**

1. To revise the science curriculum to close any gaps in environmental and life science coverage relative to the standards, PSSA Assessment Anchors and Eligible content.
2. To provide for fidelity in the implementation of the written science scope and sequence.
3. To review budgetary procedures to provide greater flexibility in modifying and adapting labs.
4. To provide extended lab time to allow for more in-depth study throughout the inquiry and problem solving process.
5. To provide additional professional development opportunities outside of the district.
6. Review class sizes to assist with providing opportunities for student engagement.
7. Review the installation and placement of GFI outlets, filing of MSDS sheets and the placement of a smoke detector in the chemical closet.

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**RECOMMENDATIONS**

- 1. Revise the science curriculum to close any gaps in environmental and life science coverage relative to the standards, PSSA Assessment Anchors and Eligible content.**

This revision must take place as a K-12 process as was previously recommended on page 14 of this report. During the interview process, teachers at the elementary and middle school levels specifically noted gaps in environmental and life science coverage.

- 2. Provide for fidelity in the implementation of the written science scope and sequence.**

Committee members, after reviewing the 6-8 scope and sequence in comparison to classroom observations found that discrepancy in curricular design contrasted against curricular implementation. The curriculum documents call for best practice –yet the dominant form of instruction is lecture. Assessments are tests, quizzes and homework. Observations by the evaluation team indicate that although inquiry learning is mentioned in the curriculum documents, it is not taking place on a consistent basis.

Marzano (2003) has identified school and teacher factors that have the greatest impact on student learning. Among school factors that promote student achievement is the existence of a guaranteed and viable curriculum. It is difficult to have a guaranteed and reliable curriculum without ensuring fidelity in its delivery.

The collaborative curriculum design process will allow all staff to come to agreement on what students should know and be able to do relative to the expressed vision for science in the district. Once such agreement is reached and checked against national standards, the Pennsylvania Standards for Science, Technology, Environment and Ecology; and the PSSA Science Assessment Anchors and Eligible Content; then structures to ensure fidelity must be reviewed. The primary mechanism for this is the district's process for evaluation and supervision. The newly established walkthrough process is also a means to do this and should be part of the process for evaluation and supervision. The review of data from common, periodic assessments should also be used to check for fidelity in implementation of the program, as well as improvement of the curriculum design.

- 3. Review budgetary procedures to provide greater flexibility in modifying and adapting labs.**

Throughout the interviews it became apparent that the constraint of this process creates difficulty in modifying and adapting labs. Reconsider five year budgetary cycle for science department. Five years may be appropriate for textbook selection

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and large-expenditure items; however a more flexible annual building budget process would allow the teachers to better meet the educational needs of the students.

**4. Provide extended lab time to allow for more in-depth study throughout the inquiry and problem solving process.**

The National Science Education Standards stress that schools must restructure schedules so that teachers can use blocks of time, interdisciplinary strategies, and field experiences to give students many opportunities to engage in serious scientific investigation as an integral part of their science learning.

**5. Provide additional professional development opportunities outside of the district.**

Throughout the interview process the faculty expressed interest in observing models of best practice outside of the district. Targeted, science specific opportunities for professional development would be useful for continuing the high motivation level of the staff. "School districts that change to improve have an obligation to provide staff with professional development that is intensive, targeted, and ongoing." The reason is straightforward: "People can be encouraged to change, but if the structure of the system in which the individuals work does not support them or allow enough flexibility, improvement efforts will fail. Similarly, if the organization's governance, policies, structures, time frames, and resource allocation are changed, but the individuals within the organization do not have opportunities to learn how to work within the new system, the improvement effort will fail" (Todnem & Warner, 1994, p. 66). Center for Comprehensive School Reform and Improvement, Newsletter, November 2006. [www.centerforcsri.org](http://www.centerforcsri.org)

**6. Review class sizes to assist with providing opportunities for student engagement.**

While the sensitivity to class size issues is recognized, and can be affected by a number of variables, it is recommended that class size be equalized where possible to increase student engagement.

**7. Review the installation and placement of GFI outlets, filing of MSDS sheets and the placement of a smoke detector in the chemical closet.**

Observers noted that the use of GFI outlets, sixth grade rooms was not consistent. All outlets in a science room should be replaced with GFI outlets with a teacher-controlled cut-off switch. You may want to have a smoke detector installed in the chemical closet.

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**HIGH SCHOOL**

**STRENGTHS**

1. The vision for K-12 science program is evident in the science documents.
2. Curriculum documents address content standards.
3. Safety practices are being implemented in science classes.
4. The Physical Science curriculum design of ½ physics and ½ chemistry meets the requirements of the assessment anchors.
5. Teachers and students have access to technology including: data collection hardware, LCD projectors and United Streaming video content.
6. Structures are in place to inform parents and community about the science program through the district web site, open house, parent visitation day, and district publications.

**NEEDS**

1. To make the vision of K-12 Science Program part of the culture of the high school science faculty.
2. To modify curriculum documents to reflect the expectations of the process standards.
3. To increase student centered standards based activities.
4. To have high expectations for all students.
5. To increase the rigor of Advanced Placement courses.
6. To develop common assessments that match the rigor of the Pennsylvania assessment anchors and provide information about students attainment of the anchors.
7. To review the building budget to provide for greater flexibility for the purchase of consumable materials.
8. To provide for consistent implementation & evaluation of the professional development (inquiry learning) plan at the administrative and classroom level.
9. To increase support for special education students in regular education classes.

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**RECOMMENDATIONS**

**1. Make the vision of K-12 Science Program part of the culture of the high school science faculty.**

The National Science Education Standards emphasize the need for the alignment of all elements of the K-12 science program. This alignment calls for connecting the philosophy or vision for the program with curriculum, teaching practices, assessment, and leadership.

Observations of instruction and interviews with teachers showed an emphasis on teaching science content. The Committee believes that there needs to be better alignment between the expressed vision of K-12 Science Program and science instruction at the High School. This is especially important because of the increased emphasis on hand-on science at the elementary and middle schools which will shape the expectations of students entering the high school in years to come.

Specific areas to revisit to effect this change are in the areas of program evaluation using the walkthrough process that is already in place in the district. The district process for evaluation of staff performance and the professional development system must also be used to support the implementation of the effective laboratory and classroom experiences regarding the process of scientific inquiry.

**2. Modify curriculum documents to reflect the expectations of the process standards**

A review of science curriculum documents for high school courses led reviewers to recommend that, as part of the revision of curriculum to align with the Pennsylvania Science Assessment Anchors and Eligible Content, that the revised science curricula reflects the expectations of the process standards. An analysis of verbs used to describe what students will know and be able to do include the following descriptors:

- |                  |               |
|------------------|---------------|
| • Know and apply | • Explain     |
| • Summarize      | • Identify    |
| • Name           | • Distinguish |
| • Describe       | • Understand  |
| • Use            | • Summarize   |
| • Review         | • Contrast    |
| • Identify       | • Solve       |
| • Trace          | • Compare     |

Note that while higher order student performances such as compare, summarize and contrast are listed, they are not used on a regular basis in any of the syllabi, including honors courses.

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We also suggest that expectations for what students should be able to do be more explicit than to “understand.” Ask, “What performances by students would be evidence of understanding.” Which of these performances requires a higher level of rigor? McTighe and Tomlinson note that when we understand we can explain, interpret, apply, have perspective, display empathy, and have self-knowledge (metacognitive awareness).

**3. Increase student centered standards based activities**

Related to the previous recommendation is a need to focus instruction on both the process of scientific inquiry and the acquisition of conceptual knowledge. The Committee recommends, as suggested in the literature, that at a minimum of once each school year every student at all levels should complete one full investigation. This student centered investigation should be designed to allow students to ask a scientific question, design and conduct a scientific investigation, use appropriate tools and techniques to gather and analyze data, develop explanations based upon evidence, think logically to make relationships between evidence and explanations, evaluate alternative explanations and communicate scientific findings. Provide lab time of a longer duration through creative scheduling – note that PSSA Science Test is process oriented and requires more hands-on experiences.

**4. Have high expectations for all students**

Select teachers informed members of the Committee that the academic students were not capable of meeting the standards and that the kids needed to change. Pacing must be different in the academic classrooms “as the kids can’t get the content.”

Supervision and professional development must be implemented to meet the challenge of maintaining high expectations of and providing effective instruction for diverse groups of students. See the comments regarding expectations in the written curricula.

**5. Increase the rigor of Advanced Placement courses.**

Increase the rigor of Advanced Placement courses. Instructors for AP Courses should attend yearly updates to ensure that their course content meets the rigor and expectations set out by the College Board. See the comments regarding expectations in the written curricula.

**6. Develop common assessments that match the rigor of the Pennsylvania assessment anchors and provide information about students’ attainment of the anchors.**

Common assessments need to be developed to meet the rigor of the Pennsylvania assessment anchors and provide information about students’ attainment of the anchors. Common assessments need to be developed and aligned to Webb’s Depth of

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Knowledge. The information provided by these assessments should support student success in meeting the expectations of the anchors as well as altering curriculum to facilitate the acquisition of knowledge and skills.

**7. Review the budget to provide for greater flexibility for the purchase of consumable materials.**

Similar to concerns expressed at the Middle School, staff expressed a need for greater building-based flexibility for the purchase of consumable materials. The Committee recommends that the five year budgetary cycle for science department be examined to address this concern.

**8. Provide for consistent implementation & evaluation of the professional development (inquiry learning) plan at the administrative and classroom level.**

The Committee recommends that the District practices for evaluation and supervision be revised to ensure fidelity in the delivery of the written curriculum. Schmoker (2006) writes of the need for principals and teacher leaders to meet regularly with teacher teams to review and discuss evidence of what is being taught. It is recommended that the “walk-through” process that be continued as a mechanism for evaluating the implementation of the curriculum and related professional development.

**9. Increase support for special education students in regular education classes.**

Increased accommodations and support are needed in regular education classrooms, e.g. use of special education itinerant teachers. Provide professional development for staff on differentiation, collaboration, and co-teaching.

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**RESOURCES**

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National Research Council. (1996) *The National Science Education Standards* National Academy Press, Box 285, 2101 Constitution Avenue, N.W., Washington, D.C. 20055. Call 800-624-6242 or 202-334-3313 (in the Washington Metropolitan Area). Printed in the United States of America. Available: <http://books.nap.edu/readingroom/books/nse/>

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