Pittsburgh Science & Technology Academy

Pittsburgh Public Schools | EXCELLENCE FOR ALL

Dream. Discover. Design.

Mathematics Teacher – Grades 9-12
2 Positions Available

7-12 Mathematics Certification Required

Posting Available: January 25-February 10, 2010

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A Great Place to Teach

In this section, the advantages and rewards of teaching at The Academy are explained.

Academy teachers are skilled professionals, and they are treated that way.

They participate in the development of the courses they teach and select the activities they lead. They have the time and support necessary to improve instruction, analyze student work, and communicate with families. And they get to make a real impact. They get to help a diverse and motivated group of young adults prepare for the world's best opportunities in science, technology, engineering, and math.

Teachers share responsibility for the success of every student as they provide daily opportunities to Dream. Discover. Design.

Leading an Involved Community

The Academy is a unique community, and teachers are its leaders. They lead a community united by a common interest in science, technology, engineering, and math, and a determination to see Pittsburgh students rise to the top of these competitive fields.

In addition to being experts in their academic discipline Academy teachers are advisors, facilitators, and project-managers. Time for these responsibilities is built into the carefully designed master schedule, and teachers are paid for an eight-hour professional day.

Benefiting from Personalized Professional Development

Professional development at the Academy is a personalized process built around hands-on learning, high expectations, and Dream. Discover. Design. Every teacher has the flexibility to shape their development time, set and monitor their development goals, and complete work that is relevant to their classroom.

Each teacher has a minimum of 80-minutes of personal planning time built into their schedule every day. An additional period of collaborative lesson study and personalized professional development is built into their schedule for one quarter of each school year.

Participating in Course Development

Since so many unique courses are offered at the Academy, time is built into teachers' schedules for the development of courses they will teach in later years. This means extra eighty-minute planning periods, access to the resources and support necessary to develop hands-on units, and guidelines provided by curriculum developers and local subject experts.

Building Positive Relationships

Every teacher is also a faculty advisor, with time for advising built into their weekly schedule. They get to follow the same small group of students from 6th through 9th grades or from the 10th through 12th grades. Advisors develop the personal relationships that are so important to student success, and they help students set and monitor goals, make decisions, and keep their families informed.

Using Time Wisely

A typical day consists of four eighty-minute academic periods. Some teachers lead classes in three of these four periods. Others, those who have additional responsibilities such as developing a new course for example, only lead classes in two of these four periods.

The four academic periods surround a flexible period in the middle of the day. Part of this period is for lunch. The rest, about 60 minutes, is for academic support, independent research, or a club or activity that would typically be offered after school.

The schedule has been carefully designed, with specific offerings planned through 2013. Teachers will know exactly what they are scheduled to teach over the next five years, so they will have plenty of time to plan and to participate or lead course development.

Producing Measurable Results

With flexibility, time, and empowerment come high expectations. The Academy expects to help every student complete advanced coursework, choose a specific college or career opportunity before they graduate, and demonstrate the ability to Dream. Discover. Design. The educators, volunteers and contributors to the development of the Academy expect the school to become a national model for science, technology, engineering, and math education and they understand that excellent teaching is the key to achieving this vision.

For more information:

- Visit www.pghscitech.net
- Call 412.325.7620

General Job Description

In this section the expectations of ALL teachers at The Academy are explained.

Job Title: Teacher
Grades: 6-12
Residency: No
Posting Opens: 1/25/10
Start Date: July 2010*

School: The Pittsburgh Science & Technology Academy
Reports to: Science & Technology Administration
Salary: Teacher Salary Scale
Posting Closes: 2/10/10
FLSA Status: Exempt

* Teachers new to The Academy cannot have a conflict due to teaching summer school

Job Scope:

Are you an energetic teacher who is always looking for new and inventive ways to teach your students? Are you a visionary teacher who prefers to allow your students to learn through experiences, discoveries and projects? The Pittsburgh Science and Technology Academy is looking for teachers like you to help our students Dream. Discover. Design. It's not just a motto; it's our way of educating students for the 21st Century. Our teachers and students will have the time and support they need in utilizing a cutting edge curriculum, the latest educational technologies and the most current, effective educational strategies. We're looking for a different kind of teacher for a different kind of school.

Mission & Vision:

- Our MISSION is to provide daily opportunities for students to Dream. Discover. Design.
- Our VISION is to make The Academy more than a school: we want to be a launching pad for ideas, for the architects of future technologies, and for success for every student.
- At the Academy:
    - Every student succeeds in advanced coursework
    - Every student selects a specific postsecondary opportunity before graduation
    - Every student demonstrates the ability to Dream. Discover. Design.

Job Goal:

The duties and responsibilities may vary, but in all cases, no less than fifty percent (50%) of such an employee's time shall be devoted to direct educational activities in the various schools of the Pittsburgh School District. In all cases, such employees shall meet the qualifications set forth in the School Code and shall abide by the Professional Standards and Conduct for Educators, as issued by the PA Department of Education at Title 22-Education Part XIV.

GENERAL JOB DESCRIPTION
Continued

Expectations & Essential Job Functions:

Includes but not limited to:

Overall Expectations

- Believe that every student can succeed with the right amount of time and support.
- Bring a positive attitude, creativity, and leadership skills every day.
- Hold every student, parent and staff member to high expectations
- Enforce and act in accordance to the Compact of Understanding
- Share the goal of making The Academy the top science and technology school in the nation.

Administration and Classroom Management

- Knowledge of management principles involved in strategic planning, resources allocation, human resources modeling, leadership technique, and coordination of people and resources.
- Maintain accurate, up-to-date grades and records
- Observe and evaluate students' performance, behavior, social development, and physical health.
- Establish all school policies and enforce rules for classroom behavior and procedures.

Communication & Parent Engagement

- Teachers at The Pittsburgh Science & Technology Academy need to have the ability and willingness to interact and communicate effectively with students, parents/guardians and community members.
- Provide productive, consistent feedback to students.
- Communicate in a timely manner with counselors, administration, parent/guardian, etc.

Education and Teaching Methods

- Prepare daily lessons for bell to bell engagement of students in a block schedule.
- Use methodology and curriculum that is student centered.
- Differentiate instruction to support all students.
- Provide daily opportunities to Dream. Discover. Design. through a balanced program of instruction, cross-curricular lessons, project based learning, inquiry based learning, rigor/relevance framework, co-operative learning, demonstration, and work time.

Legal

- Full adherence to the Faculty Handbook, Pittsburgh Public Schools Rules & Regulations, Pennsylvania School Code, Pennsylvania Loyalty Act and No Child Left Behind Act.

GENERAL JOB DESCRIPTION
Continued

Literacy & Mathematics

- Knowledge of arithmetic, algebra, geometry, statistics, and their applications as well as basic reading, writing and literacy skills. This knowledge will be used not only in the calculation of grades but also in the use of implementing math and literacy concepts in all curricular areas.

Professional & Curricular Development

- Participate/contribute to extensive and ongoing professional development.
- Contribute to curriculum writing and the development of curriculum enhancements.
- Serve on school/staff improvement committees.

Student Support & Advising

- Teachers at The Pittsburgh Science & Technology Academy are expected to provide individualized help and services to our students as needed.
- Advise a group of students on a weekly basis through their Academy experience.

Summer Orientation Program

- All faculty entering their first year at The Academy will be compensated for a summer orientation program lasting up to five weeks. This program may begin as early as July 1st and include Professional Development, Curriculum Writing and Classroom Preparation. Teachers are expected to be fully available and can not have a conflict due to teaching summer school. Teachers will be compensated for these professional days at workshop rate ($23.32 per hour).
- All teachers will report for up to five days prior to the normal contractual beginning of the school year. All teachers will be compensated for these professional days at pro-rata pay.

Technology

- Specific technological skills are not required however every teacher will have technology available for professional use. The expected use of this technology includes but is not limited to: electronic communication, electronic grade book, infusion of technology into all courses and lessons, etc.
- Utilize and infuse available technology regularly into all courses.

Work Day

- Work an extended 8 hour school day in a regular 182 day school year.
- Take advantage of daily 80-minute planning period.
- Wear appropriate teacher dress which sets a positive example to students and a constructive influence on the general comportment of students and on the overall learning atmosphere in the school in accordance to contract.

GENERAL JOB DESCRIPTION
Continued

Qualifications/Certification:

- PA Instructional Certificate
- Bachelor's Degree minimum
- At least 18 years old
- U.S. Citizen
- All paperwork required by both PDE & PPS including required clearances

Physical Demands:

This position involves a combination of standing and sitting to provide classroom instruction, modeling or assistance. The position may require escorting children throughout the building. Employee will be required to operate a computer, and have the ability to complete necessary paperwork. This position requires minimum physical effort and is not subject to Occupational Health and Safety risks.

Work Environment:

Teachers at The Pittsburgh Science and Technology Academy must believe in, value and be committed to the educability of all; must promote the school and district vision of high standards of learning and academic rigor, continuous school improvement, and the inclusion of all members of the school community; must possess and maintain the energy necessary to meet the responsibilities and expectations of the position.

- Indoors in busy office, working in close proximity to co-worker
- Frequently required to work at fast pace
- Requires considerable concentration and creativity
- Subject to stress caused by a changing environment, diversity in the organization, tight deadlines and work load.

Specific Job Description

Each teaching position at The Academy is listed separately as a unique posting due to the distinctive schedule and responsibilities, which are listed here.

Teachers 12 & 15
High School Mathematics Teachers

Year Starting
July 2010
Certification
7-12 Mathematics Certification Required
Teaching Positions Available
TEACHERS 12 & 15

The probable schedules for both of these positions are located at the end of this section. In each case, the classes are taught to students during the high school years.

During third period all teachers lead an activity or support section for 3/4 of the year and have 1/4 of the year reserved for a period of collaborative planning and lesson study.

All teachers meet with an advisory group every Wednesday during third period.

Special Responsibilities
Includes but not limited to:

- Knowledge of State, Local, and Federal laws and regulations affecting the lives and education of students.
- Utilizes student analysis results & approved courses of study to develop lesson plans for assignments & activities which meet identified students needs.
- Create and adapt curriculum according to student's individual learning style
- Teach basic skills and content using a variety of motivating instructional methods
- Conducts on-going assessment of student progress to update records of students needs & corresponding instructional & training program.
- Other duties as assigned

SPECIFIC JOB DESCRIPTION
Continued

Schedule for Teacher 12
Mathematics

Probable Schedule – 2010-11			
Teacher 12: Mathematics Teacher			
Period	**Length in minutes**	**Semester 1**	**Semester 2**
1	80	Planning	Planning
2	80	Algebra II Semester	Pre-Calculus Semester
3	99	Professional Development Activities, Advisory, Academic Support	
4	80	Specialized math	
5	80	Geometry	
Probable Schedule – 2011-12			
Teacher 12: Mathematics Teacher			
Period	**Length in minutes**	**Semester 1**	**Semester 2**
1	80	Planning	Planning
2	80	Geometry	Geometry
3	99	Professional Development Activities, Advisory, Academic Support	
4	80	Geometry	Geometry
5	80	Geometry	Geometry
Probable Schedule – 2012-13 & Beyond			
Teacher 12: Mathematics Teacher			
Period	**Length in minutes**	**Semester 1**	**Semester 2**
1	80	Planning	Planning
2	80	Geometry	Geometry
3	99	Professional Development Activities, Advisory, Academic Support	
4	80	Geometry	Geometry
5	80	Geometry	Geometry

SPECIFIC JOB DESCRIPTION
Continued

Schedule for Teacher 15
Mathematics

Probable Schedule – 2010-11			
Teacher 15: Mathematics Teacher			
Period	**Length in minutes**	**Semester 1**	**Semester 2**
1	80	Algebra II Semester	Pre-Calculus Semester
2	80	Algebra ll Year	
3	99	Professional Development Activities, Advisory, Academic Support	
4	80	Algebra ll Year	
5	80	Planning	
Probable Schedule – 2011-12			
Teacher 15: Mathematics Teacher			
Period	**Length in minutes**	**Semester 1**	**Semester 2**
1	80	Planning	Planning
2	80	Geometry Semester	Geometry Semester
3	99	Professional Development Activities, Advisory, Academic Support	
4	80	Algebra ll	
5	80	Algebra II	
Probable Schedule – 2012-13 & Beyond			
Teacher 15: Mathematics Teacher			
Period	**Length in minutes**	**Semester 1**	**Semester 2**
1	80	Algebra ll Semester	Pre-Calculus Semester
2	80	Geometry Semester	Algebra ll Semester
3	99	Professional Development Activities, Advisory, Academic Support	
4	80	Geometry Semester	Pre-Calculus Semester
5	80	Planning	

Application Instructions and Materials

This page provides instructions for applying and a list of materials that must be turned in for your application to be considered.

Instructions

1. Review this packet thoroughly.
2. Fill out an online electronic application
    a. Current PPS employees apply at: https://apply.pps.k12.pa.us/internal
    b. Non-PPS employees apply at: https://apply.pps.k12.pa.us/external
3. Mail the following list of required materials to:

    Pittsburgh Public Schools
    Human Resources Department, Room 142
    341 S. Bellefield Ave.
    Pittsburgh, PA 15213

4. Finalists will be interviewed by a panel during or close to the week of 2/22/2010.

Required Materials - To be mailed as listed in #3 above

1. A resume & copy of your most current Pennsylvania Teaching Certificate
2. Three letters of recommendation including author's contact information. Suggested authors include administrators, supervisors or academic coaches. Special attention will be given to letters that reflect your skills in lesson planning and instruction.
3. Using the Observation Preferences Form (see Appendix II), list at least three available times during the weeks of 3/8/2010 to 3/19/2010 when the Principal and interview panel can observe your classroom for 20-30 minutes (if applicable).
4. Please read the paper titled "Research and Program Theory" (see Appendix III) about the creation and basis of the Academy. Please submit an essay with your application packet of no more than 1-2 pages which helps us to understand how your style and abilities would fit into our school. Please cite specific examples and strategies and discuss your comfort level with the use of technology.
    Specific Essay Instructions:
        1. Create your own letterhead for the essay
            a. Include a picture or graphics into the letterhead
            b. Font of letterhead should be different than body of essay
            c. Change font/font size or use underline or italics in the essay to add emphasis at least once
        2. Please mail the essay with the required materials
5. External applicants (not currently employed as a PPS teacher) must also submit the PA Standard Application and Act 34, Act 151 and Act 114 FBI Fingerprint Clearances.

Appendix I: Compact of Understanding

We, the undersigned, endorse and agree to the following principles which represent the core values of the Academy and establish the expectations for student and stakeholder conduct. Success in the Pittsburgh Public Schools and at the Pittsburgh Science & Technology Academy depends upon students, teachers, parents and staff adhering closely to the agreement below.

As a STUDENT at The Pittsburgh Science & Technology Academy, I agree to follow "The Five P's" at all times.	**As a PARENT/GUARDIAN with a student at The Pittsburgh Science & Technology Academy, I agree to follow "The Five Ps" previously outlined and also to:**	**The STAFF at The Pittsburgh Science & Technology Academy agrees to follow "The Five P's" previously outlined and also to:**
Be Prompt - I am ready to work when the bell rings. - I turn in my work on time. - I follow directions immediately.	**Be Insistent** - Insist upon timely regular attendance. - Insist that my child take pride in their work - Insist that my child strives for good grades - Insist that my child plans for their future. - Insist that my child follows "The Five Ps"	**Be Fair** - Communicate regularly with families. - Equitably enforce the Code of Conduct - Welcome and encourage family involvement
Be Prepared - I come to class ready to work. - I do my homework assignments. - I study for exams. - I dress appropriately.	**Be Involved** - Make sure my child has all necessary materials. - Hold my child accountable for excellent work. - Support and collaborate with Academy staff. - Listen to the feedback of teachers and staff - Act on the recommendations of staff members	**Be Firm** - Maintain professional attendance - Maintain professional conduct - Provide rigorous and relevant instruction - Maintain a safe and structured environment - Expect respect, and show respect for others - Consistently reinforce The Five Ps.
Be Polite - I listen and speak respectfully. - I allow others to express themselves. - I respect others' personal space. - I give compliments. - I criticize constructively.	**Be Interested** - Talk about school with my child every day - Maintain open dialogue with my child's school - Volunteer and participate in school activities	**Be Flexible** - Recognize that every student can succeed - Recognize that different students need different amounts of time and support - Constantly improve lessons and instruction - Develop positive relationships with students.
Be Productive - I participate actively in class. - I work to the best of my ability. - I work from bell to bell. - I work with team members. - I complete my class assignment. - I produce excellent work.	**Be Informed** - Consistently review my child's grades - Know and support my child's adherence to the Student Code of Conduct - Attend Parent/Teacher Conferences - Listen to the feedback of teachers and staff - Trust the intentions of teachers and staff.	**Be Fun** - Provide opportunities to Dream. Discover. Design. - Bring passion and creativity to your job. - Smile!
Be Positive - I believe in my ability. - I encourage my classmates. - I take pride in myself, my work and my school		
Student Signature _____ **Student Name (Printed)** _____ **Date:** _____	**Parent/Guardian Signature** _____ **Parent/Guardian Name (Printed)** _____ **Date:** _____	**Staff Signature** _____ **Staff Name (Printed)** _____ **Date:** _____

Appendix II: Observation Form

- *PPS Teachers Only - Please submit this form with application packet.*
- *Non-PPS Teachers will be asked to perform a mock lesson as scheduled by the principal.*

Applicant Name: _____

Current School: _____

- Please list at least three dates and times between 3/8/10 and 3/19/10 when the principal and interview team can come to observe you in your classroom.
- Please select times when you are likely to be presenting content as opposed to student independent practice.

Day and Date	Time	Room Number	Notes/Comments (Optional)
Example: Tuesday	9:05-9:30	312	Room doesn't have window on door - feel free to walk in

Appendix III: Research and Program Theory

Please read this information as the basis for the essay component to the application.

Introduction

One and a half years of intensive research have made it very clear that there is not one recipe for overcoming the nine challenges identified in *Defining the Challenge*.[1] Instead, schools that are achieving outstanding results look very different from one another. "Breakthrough" schools have different sizes, different schedules, and different systems. They do not share a curriculum or have a similar technology plan.

However, despite their differences, successful schools do share some common characteristics. Successful schools have a well defined outcome goal for their students. They also are guided by a set of fundamental decisions. Although these decisions are not always clearly defined or communicated, they form a coherent program theory, a strategy for overcoming the challenges identified and achieving the goal that has been established.

Ideally, these decisions are a constant presence in the school. They should be drawn from a diverse set of research relevant to public education, and should be referenced when difficult decisions are being made. It is these philosophical and strategic decisions that inform all educational elements of the school and unite the various systems that operate within it.

In this essay fundamental decisions are presented in three categories, (1) Philosophical decisions; (2) Strategic decisions; and (3) Systemic decisions. A comprehensive body of research contributed to these decisions, and guides learning at Pittsburgh Science and Technology. An introduction to this research precedes an explanation of the decisions themselves. Please see the final essay in this series, *Sample Sources,* for an identification and explanation of important sources in each research category. A complete bibliography is included with the report.

Research Methods

The significant body of research that has contributed to the design of Pittsburgh Science and Technology is organized into three primary categories; (1) Secondary literature review, (2) Benchmarking and best practice research, and (3) Primary research. At the end of this document, important sample sources from each of these categories are summarized.

[1] Defining the Challenge is the previous essay in this report, describing the challenges facing a new, urban public school.

1. Secondary Literature Review

A broad secondary literature review continues to contribute to the Academy design and implementation process. The review began with several books designed to provide background on the challenges related to urban public education in the 21st century. It expanded to include journal articles obtained primarily through ERIC, the Education Resources Information Center, and JSTOR, an online archive of academic journals. Dozens of reports, evaluations, and newspaper and internet items were subsequently reviewed. The content of these secondary sources fits into five primary subcategories:

a. Education theory – Including Alfred North Whitehead's essays Aims of Education and Rhythms of Education;
b. Education Policy Research – Including more than 150 books, reports, journal articles, and evaluations related to Organizational Structure, Curriculum, Budgeting, Professional Development, Technology Integration, Human Resources, Partnership Development, and more;
c. Historic and historiographical analysis - Consisting of approximately 50 books and essays;
d. Science and technology specific history, theory, and cognitive development sources; and
e. Case studies.

2. Benchmarking and Best Practice Research

In addition to information obtained in the secondary source review, dozens of existing schools and comprehensive school reform models were studied. The research and design team worked to identify best practices for each of the systems that operate within a school. Benchmarking focused on Organizational Structure, Curriculum, Staff and Administrative Composition, Professional Development, Curriculum, Technology Integration, Location, Facilities, and Transportation, Budget, and Public and Private Partnerships.

We first consulted a list of the Top 1,000 US Public Schools identified by Newsweek. We focused upon the top 100 schools on the list, and then further narrowed the list by focusing solely upon schools in which at least 35 percent of the students received free or subsidized lunches. This constraint was placed to give attention to schools with students of similar socioeconomic circumstances to PPS students, and to eliminate schools with greater financial resources.

We also benchmarked a number of schools that are members of the National Consortium for Specialized Secondary Schools of Mathematics, Science, and

Technology (NCSSSMST). This consortium consists of schools whose primary

purpose is to academically prepare students for leadership in mathematics, science, technology fields. Benchmark Schools include:

a. Thomas Jefferson High School for Science and Technology, Alexandria, VA;
b. South Carolina's Governor's School for Science and Mathematics; and
c. Academy for the Advancement of Science and Technology, Hackensack, NJ.

In addition to schools identified through these two sources, we benchmarked Comprehensive School Reform Models, Breakthrough High Schools identified by the National Association of Secondary School Principals (NASSP), and outstanding or unique schools identified through word of mouth or through our secondary literature review. Benchmark schools include:

a. Talent Development High Schools, Center for Social Organization of Schools, Johns Hopkins University;
b. School Without Walls, Rochester, NY;
c. The Denver School of Science and Technology, Denver, CO;
d. University Park Campus School, Worcester, MA;
e. Creative and Performing Arts High School, Pittsburgh, PA; and
f. Urban Academy, New York, NY;

Please see the following essay titled *Sample Sources* for a description of how these influential schools informed our design.

3. Primary Research

Finally, three types of primary research contributed to the original design and continue to improve and expand it during the implementation phase. The three types of primary research are described below.

a. School visits – Team members have now visited a diverse sample of schools in Southwestern Pennsylvania and in other cities including New York, Oakland, Denver, Boston, and Milwaukee. Visited schools include private, public, and charters at the elementary, middle, and high school levels.
b. Focus groups – Focus groups composed of experts in science and technology education have been convened to address specific questions primarily related to curriculum development. These focus groups did not contribute significantly to the original design, but have influenced its expansion and revision, and are an important part of the implementation plan.

c. Consultation, Interviews and Personal Communication – The input of parents, professors, teachers, administrators, nonprofit sector and industry representatives, and regional leaders have been an important part of the design.

Together, these sources led to the following set of fundamental decisions. These decisions guide decision making during implementation and provide the foundation for the systems that will operate at Pittsburgh Science and Technology.

Philosophical Decisions

Together this significant set of sources has led to the following decisions, decisions which should guide curriculum development and scheduling.

1. Recognize the cognitive potential of all students and accept responsibility for their achievement.

The Academy believes in the ability of all students to succeed in advanced coursework and connect to a relevant postsecondary opportunity. Outstanding schools are currently supporting this conclusion by connecting more than 90% of students to college, including students who entered with significant academic deficits.

The fact that all students have the *potential* to succeed in advanced coursework and access a personally meaningful postsecondary opportunity does not mean that a traditional school is equipped to realize this possibility. A school that is willing to accept responsibility for the success of all students and design academic programs and support systems to meet this challenge will achieve this.

Furthermore, all students are not capable of meeting the demands of advanced coursework in the same amount of time, or with the same level of support. Some students will require significantly more academic time and academic support to develop the prerequisite skills, study habits, and confidence necessary to tackle advanced work. Therefore the school must build flexible systems for promotion, and a continuum of interconnected support systems capable of meeting changing needs of individual students in real time.

It is not expected that all students will graduate at the same level. Certainly some students, through a combination of innate ability and external circumstances, have the ability to move well beyond the high expectations established for all attendees. However, it is the expectation that all students will graduate having reached a threshold that includes advanced coursework and ensures that they are prepared to meet the expectations of higher education or the 21st century workforce.

Finally, in an ideal situation, families would have the resources and ability to support their high school senior secure an opportunity in postsecondary education or find a job. However, this is not the reality. Therefore, rather than blaming families as they watch students grasp for opportunity, schools in the twenty first century must be willing to accept responsibility for connecting students to an appropriate opportunity.

In summary, the school must recognize that all students have the potential to succeed while at the same time understanding that students have different needs and abilities at different times. Instead of a specific age based framework for learning, "what children are capable of at a particular age is the result of a complex interplay among maturation, experience, and instruction. What is developmentally appropriate is not a simple function of age and grade, but rather is largely contingent upon opportunities to learn".[2]

2. Build the program, lessons, and sequences to align with the "Rhythms of Education": Dream. Discover. Design.

In his famous essay titled *Rythms of Education* Alfred North Whitehead describes three essential stages of education. He argues that all learning should progress through each of the following stages.[3]

The table below summarizes the stages identified by Whitehead and how they have been adapted to the Science and Technology academy to form Dream. Discover. Design., the core of the Science and Technology mission and experience.

"Rhythms of Education"	Modified Key Words	Lessons	Units	Full PST Program
Romance "the vividness of novelty" and the excitement of unexplored connections	**Dream**	Open lessons with a "hook" that inspires curiosity, establish objectives and assess results	Generate questions, set big goals, generate ideas	Students demonstrate curiosity, creativity, and entrepreneurship while consistently monitoring progress toward long term goals
Precision "width of relationship is subordinated to exactness of formulation"	**Discover**	Conduct research and discover new skills and/or information	Acquire knowledge and skills through research	Students constantly lead and participate in research and exploration
Generalization "a return to romanticism" with "the added advantage of classified ideas and relevant technique"	**Design**	Apply new information/skills to real situations or new types of problems, produce something tangible	Apply knowledge and skills to answer questions through inquiry driven projects which produce something tangible	Research and exploration consistently culminates in an object or product which can be touched, presented or displayed

2 1. Duschl, R.A., H.A. Schweingruber, and A.W. Shouse, eds. Taking Science to School: Learning and Teaching Science in Grades K-8. ed. N.R.C.o.t.N. Academies. 2007, The National Academies Press: Washington, D.C.

3 2. Whitehead, A.N., The Rythms of Education, in The Aims of Education and other essays. 1929, The Free Press, A Division of Macmillan Publishing Co., Inc.: New York, NY. p. 13.

a. Dream – (Whitehead's stage of romance), when the subject matter has "the vividness of novelty" and the excitement of unexplored connections.
b. Discover – (Whitehead's stage of precision), when "width of relationship is subordinated to exactness of formulation". This stage is deemed the "stage of grammar", the grammar of language and the grammar of science. According to Whitehead, precision is nothing without being preceded by romance because there must be a broader context for the facts and a general understanding of their context.
c. Design – (Whitehead's stage of generalization. This stage is "a return to romanticism" with "the added advantage of classified ideas and relevant technique".

The graphic on the previous page outlines how the Academy curriculum has adapted, modernized, and tailored Whitehead's Rhythms of Education[4] to the needs of a 21st Century science, technology, engineering, and mathematics focused program. The full Academy curriculum, units, and daily lessons will be designed and implemented according to these three stages.

3. Understand that excellent teaching is the key to success.

The Results of "value-added" studies demonstrate the tremendous impact that a single teacher has on the academic trajectory of his or her students. For example, in Tennessee, the difference in academic gains produced by the most effective and least effective teachers averages between 35 and 40 percentile points in a single school year, an effect that is multiplied by a string of either effective or ineffective teachers.[5] Together, these studies led The Education Trust to conclude that teachers are the single biggest factor in determining the achievement of a student, greater even than poverty, race, or parents' education level.[6] The Alliance for Excellent Education adds that "persuasive research demonstrating the relative importance of instruction for student achievement – as against other contextual factors – has brought about a dramatic emphasis in recent years on the quality of teaching."[7]

Because it is clear that the quality of instruction will determine the success of Pittsburgh Science and Technology all systems must be designed to attract, develop, and retain excellent teachers. The time constraints, isolation, poor scheduling, burdensome development requirements, and ineffective evaluation systems that contribute to the frustration often felt by teachers in urban public schools must be resolved.

Thus the Academy hopes to implement a "professional approach to teaching". This is characterized by a respect for and empowerment of teaching professionals. Teachers have

4 Alfred North Whitehead's Rhythms of Education are explained in the previous section of this document.

5 4. Carey, K., The Real Value of Teachers: If good teachers matter, why don't we act like it? Thinking K-16, 2004. 8(1): p. 44.

6 5. Haycock, K., Good Teaching Matters: How Well Qualified Teachers Can Close the Gap. 1998, The Education Trust: Washington, DC. p. 16.

7 6. Tapping the Potential: Retaining and Developing High-Quality New Teachers. 2004, Alliance for Excellent Education: Washington, DC. p. 80.

more time to develop quality lessons, have structured time for collaboration, see less students each day, benefit from professional development that is self-guided and during the school day, and participate in systemic decision making.

Treated like professionals, these teachers are also expected to produce professional results. Given the unique systems that make success possible and development productive, teachers should produce significant academic gains. A new system of accountability will measure results accurately and evaluate teachers accordingly.

4. Operate in Pasteur's Quadrant.

The relationship between the quest for fundamental understanding on one hand, and considerations of use on the other has been a subject of continuous debate in the scientific community. Similarly, there is historic disagreement about the relationship between science and technology. For the past sixty years, the former view - of science as a quest for fundamental understanding independent of utility or application - has been predominant. Technology has been viewed as a product of pure science rather than vice versa.

Donald Stokes influential book Pasteur's Quadrant challenges these popular perceptions.[8] He demonstrates that science has historically been a product of technology more than technology a product of science. He suggests that, ideally, scientific exploration should be inspired both by considerations of use *and* by a quest for fundamental understanding. Louis Pasteur is identified as an example of a scientist whose work combined these two purposes which were often viewed as incompatible. Thus, science and technology are not separated, with one being the product of the other, but they are brought together in "Pasteur's Quadrant".
At Pittsburgh Science and Technology, science and technology are brought together in four SciTech concentrations. Inquiry driven projects seek to integrate the practical with the purely scientific. Certain experiences ask students to solve problems by developing technology, solving the problem, and then formulating a scientific explanation, a technology first approach. Other projects ask them to formulate a scientific explanation, and then test it with technology, or to create a technology tool as the product of a scientific exploration.

While students will learn technology skills such as Microsoft Office, Internet, keyboarding skills, and other technology basics, this is not the "technology" in Pittsburgh Science and Technology. We believe that students should acquire these important skills in *all* Pittsburgh Public Schools. Since the Science and Technology Academy is designed for students who are particularly interested in technology the definition of technology at the Academy should be broader.

8 7. Stokes, D.E., Pasteur's quadrant : basic science and technological innovation. 1997, Washington, D.C.: Brookings Institution Press. xiv, 180 p.

Technology at the Academy is understood on several levels:

a. A set of basic skills that all students should master;
b. Tools that improve instruction and communication;
c. A set of high level skills that empower complex problem solving;
d. A driving force in scientific advancement and exploration today and throughout human history;
e. An element of the "utility" that should exist in scientific processes; and
f. A product of scientific research.

5. Balance depth and breadth but emphasize depth.

In *Aims of Education* Alfred North Whitehead cautions against "teaching small parts of a large number of subjects". Instead he advocates teaching fewer subjects very thoroughly, and doing so in a way that explores their connections with other disciplines. He suggests that, "What education has to impart is an intimate sense for the power of ideas, for the beauty of ideas, and for the structure of ideas, together with a particular body of knowledge which has peculiar reference to the life of the being possessing it".[9]

Whitehead's thesis is supported by our research and benchmarking. We found that students are more likely to stay in school, retain information, and score higher on standardized tests when their education includes opportunities for in depth exploration. Maximum results were achieved when these experiences were tailored to the interests of students, empowering them to become experts in a field that is personally significant.

We do not expect that all graduates of Pittsburgh Science and Technology will become scientists. But by focusing instruction with specific Science and Technology themes and allowing students to acquire information through the pursuit of a field of interest, students will acquire thinking and learning skills that can be applied to any other experience.

Choosing depth over breadth requires willingness by the school and the teacher to integrate standards that are often taught disparately. More controversially, it requires willingness to bypass certain standards altogether in order to teach others in great depth. The staff must analyze state standards, identifying those that are most important. Students and outside experts should be included in this process.

Linda Darling Hammond argues that "schools can demand rigorous intellectual work from students only if they are willing to forgo the goal of superficial content coverage." Successful schools follow the Coalition of Essential Schools' (1994) guiding principle of "less is more," carefully choosing what to focus on so that students gain in-depth

9 8. Whitehead, A.N., The Aims of Education, in The Aims of Education and other essays. 1929, The Free Press, A Division of Macmillan Publishing Co., Inc.: New York, NY. p. 14.

understanding, rather than superficial exposure to large quantities of information. This applies not just to curricular choices "but also to the entire school program".[10]

Selecting the 125 most "fundamental" standards from a list of 200 does not mean selecting the easiest, or the most basic. To the contrary, it means selecting the concepts that are the most fundamental to mastering the discipline, to solving problems, and to the continuing pursuit of the discipline. In fact, the easier concepts should not always precede the harder concepts, and difficulty should not be something that is avoided or postponed.

Common sense recognizes that it is difficult to make instructional sacrifices. The current paradigm understandably emphasizes offering as many courses as possible and touching on as broad a range of standards and skills as can be taught in a single school year. This thinking is based on a legitimate desire to expose students to the exciting breadth of knowledge that exists in every discipline.

But the desire to expose students to every piece of information must be resisted by understanding the importance of in depth exploration. It is exploration and inquiry, and the deep interaction with fundamental ideas that engages students in their education and teaches the higher order thinking skills necessary for success in a dynamic economic era.

Strategic Decisions

1. Add flexibility to the traditional age-graded system.

In our "age-graded" school system there are two alternatives for addressing the needs of students who do not meet expected achievement standards. Unfortunately, neither

retention nor social promotion addresses the needs of the student. Neither one impacts student achievement, contributes to closing the achievement gap, or reduces dropout rates.[11] A new urban school should break out of the traditional age graded system that leaves administrators and teachers with these two unfortunate choices. Basic school restructuring can help a high school avoid the social promotion/retention conundrum.[12]

In abandoning the age-graded system, the challenge is to create a "continuum of interconnected intervention systems" that effectively address barriers to learning and allow problems to be solved proactively.[13] Non-graded and multi-age classes, looping, and "promotion gates" are structural components that are currently being used by innovative schools to create this type of flexible program.

10 9. Darling-Hammond, L., Redesigning Schools: 10 Features of Effective Design. 2002, School Redesign Network, Stanford University: Stanford, CA. p. 75.

11 10. Grade Retention: What's the Prevailing Policy and What Needs to be Done? 2006, UCLA: Los Angeles, CA. p. 15.

12 11. Davenport, S., Antonio Delgado, Marlene Meisels, Donald R. Moore, Rethinking Retention to Help All Students Succeed: A Resource Guide. 1998, Designs for Change: Chicago, Illinois. p. 14.

13 10. Grade Retention: What's the Prevailing Policy and What Needs to be Done? 2006, UCLA: Los Angeles, CA. p. 15.

2. Emphasize interdisciplinary education and experiences.

In accordance with our decision to emphasize in-depth exploration and provide coursework that integrates the practical with the purely academic, we feel that it is important to emphasize interdisciplinary experiences.

Currently, high school students in the United States score below their international peers in math and science. In Pittsburgh, 35.6 % of 11th graders perform at a below basic level in math.[14] Therefore, it is more vital than ever that teachers make coursework in math and science relevant, accessible, and exciting to students. Teaching practices and topics that arouse student interest "can help motivate students to learn and increase achievement."[15]

In our system, teachers work in an interdisciplinary framework to determine a topic or theme, incorporate appropriate student skill development, and integrate it into the curriculum. Coursework will use specific concentrations, projects, and themes to combine and teach broader and traditional subject areas.

3. Provide additional support during transition years.

We recognize a need to focus additional resources and energy to support students through important transition years. The transition from 5th to 6th grade, 8th to 9th grade, and 12th grade to postsecondary education or employment can be the most challenging for students, particularly for those who do not have a strong family support system.

Data collected about the ninth grade provides an example of the need for additional academic support and structure during these transitions. Ninth grade is often considered to be the most challenging grade for students. In addition to academic pressures, students face social pressures and often have trouble transitioning from middle school to high school. School districts nationwide, including PPS, report that roughly 20 percent of all 9th graders are being retained. Additionally, the largest percentages of failing grades are exhibited at the 9th grade level, 25.5 percent, compared to 5.7 percent in the 8th grade. In order to address some of these problems, some high school curricula are specially tailored to assist 9th graders in the transition from middle school to high school through the creation of interdisciplinary 9th grade academies.[16]

14 12. District's 2007 PSSA Test Scores Show Gains for Second Consecutive Year, in Pittsburgh Public Schools News. 2007, Pittsburgh Public Schools Communications and Marketing: Pittsburgh.

15 13. Bloom, R.D.S. and M.J. Halpin, Integrating Pharmocology Topics in High School Biology and Chemistry Classes Improves Performance. Journal of Research in Science and Teaching, 2002. 40(9): p. 922-938.

1614. Chute, E., Back to School: Ninth grade proves to be a pivotal year for youths, in Pittsburgh Post-Gazette. 1999: Pittsburgh, PA..

4. Create additional instructional time and emphasize "time on task".

Additional instruction time for students who are struggling in math is recommended by organizations such as the Bill and Melinda Gates Foundation.[17] Increasingly, high schools are exploring the option of extending Algebra I from a one-year course to a two-year course. In addition, comprehensive high school reform models, such as Talent Development High Schools (TDHS), recommend reserving an additional class period for "transitional" or "challenge" classes. The emphasis on "time-on-task" also applies to teachers, who should have professional development opportunities built into the school day, and have time in their schedule to plan, analyze student work, and handle their classroom's administrative responsibilities.

Systemic Decisions

1. Implement a block schedule.

Although there are challenges associated with block scheduling it has the potential to increase student engagement, improve student attitudes, and decrease both absenteeism and disciplinary infractions. The block schedule also allows teachers more time for differentiated instruction and for teaching problem-solving skills.[18]

2. Develop inquiry-driven, project-based coursework and emphasize "authentic instruction".

Inquiry based science curricula have the greatest impact on student achievement.[19]

A 1995 study by Newmann, Marks, and Gamoran supports the ability of authentic curricula to affect student outcomes. Their study of more than 2,000 students in 23 restructured schools, most of them in urban areas, found much higher levels of achievement on complex performance tasks for students who experienced what these researchers termed "authentic pedagogy"— instruction focused on active learning in real-world contexts calling for higher-order thinking, consideration of alternatives, extended writing, and an audience for student work.[20]

Interdisciplinary, project based courses are consistently preferred by students. Instead of tedious math or science worksheets or drills, students prefer to participate in projects that they can relate to real-world applications.

17 15. Improving Math Performance. 2006, Bill & Melinda Gates Foundation: Seattle, WA. p. 6.

18 16. Lewis, R.W., Block Scheduling: Changing the System. 1999, University of West Alabama. p. 11.

19 17. Clewell, B.C., Clemencia Cosentina de Cohen, Patricia B. Campbell, Lesley Perlman, Review of Evaluation Studies of Mathematics and Science Curricula and Professional Development Models. 2004, The Urban Institute. p. 97.

20 9. Darling-Hammond, L., Redesigning Schools: 10 Features of Effective Design. 2002, School Redesign Network, Stanford University: Stanford, CA. p. 75.

3. Design curricula that are aligned with educational and economic opportunities.

Education reform should not take place in a vacuum. Challenges facing the education system are inherently linked to social, community, and economic issues. Therefore reform should be conducted with this understanding. Aligning reform with larger social and economic changes is a significant challenge, but at the very least students should acquire skills which will empower them to succeed in the economy of the day. Without a strong connection between high school standards and the expectations of both postsecondary institutions and employers, "the high school diploma will remain a credential of little value."[21] Accordingly, high schools that focus specifically on the subject areas of mathematics, science, and technology are growing in number, as jobs in these areas continue to increase.

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14. Chute, E., *Back to School: Ninth grade proves to be a pivotal year for youths*, in *Pittsburgh Post-Gazette*. 1999: Pittsburgh, PA.
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21 18. Closing the Expectations Gap 2006: An Annual 50-State Progress Report on the Alignment of High School Policies with the Demands of College and Work. 2006, Achieve, Inc. : Washington, D.C. p. 32.