STEM Department: Educational Goals Update 2016-2017

"Advances in science, technology, engineering, and mathematics (STEM) have long been central to our Nation's ability to manufacture better and smarter products, improve health care, develop cleaner and more efficient domestic energy sources, preserve the environment, safeguard national security, and grow the economy" FEDERAL STEM EDUCATION STRATEGIC PLAN

In October of 2014, a pilot group of teachers and administrators started examining the opportunities provided by the school district for students to engage in STEM activities with the goal of developing a coherent STEM program. Strategic planning meetings held during the year then emphasized the community's desire for a more expansive, coordinated STEM program. Additional pilot group meetings and in depth discussion during the early months of 2015 highlighted the need for a district-wide STEM initiative. July 2015 saw the start of a more rigorous and detailed examination of the STEM opportunities and the start of the school district's STEM initiative.

Any new initiative requires guidance, a framework to work within, and a vision that determines the direction of the initiative. Discussion between groups of teachers at various grade levels and input from administrators has led to the proposal of the STEM Educational Vision shown below

New Providence will prepare and inspire the next generation of students to meet the challenges of a global society through a series of rigorous and challenging courses in the integrated areas of Science, Technology, Engineering and Math. The program will emphasize 21st Century skills while incorporating 'real world' innovation, critical thinking, and creative problem solving skills, in association with community and industry partnerships.

Along with this vision, enduring understandings that frame the direction of the initiative are also being proposed. These suggest that the initiative will…

*. be a **long term process**, a 5-year plan of curricular integration and extracurricular opportunities*
. provide real world, problem-based, rigorous and relevant learning experiences for students
. prepare students for STEM related careers in the global economy
. develop STEM Literacy and 21st Century skills
. create 'STEM' as a culture, not just a class
. involve a variety of community and business partnerships
. be validated by industry demands for critical thinkers and problem solvers

(Adapted from Stem School Study, STEM Lesson Essentials)

As the New Providence STEM initiative is implemented over the coming years, students should ideally be exposed to an increasing intensity of experiences as they progress through the grade levels. These are summarized into three major grade level groupings as shown in the following descriptions and in Figure 1.

- **K-4** — Students are provided with numerous opportunities to experiment with activities that expose them to the whole variety of STEM fields and occupations. The intent is that through inquiry-based and real world problem-based integrated learning that connects all four of the STEM subjects, students will develop an interest in pursuing STEM courses. Emphasis should also be placed on bridging in-school and out-of-school STEM learning opportunities.

- **5-8** — Students continue to be exposed to the STEM fields and occupations as the courses become more rigorous and challenging to reflect the academic requirements of such fields. More real world, specialized STEM exposure is provided and student choice in pursuing different STEM fields is encouraged as this exposure increases.

- **9-12** — Students are provided with in depth course electives that allow them to pursue a STEM pathway through their high school years. Opportunities for STEM related extracurricular competitions in various fields help prepare students for college and career pathways in STEM.

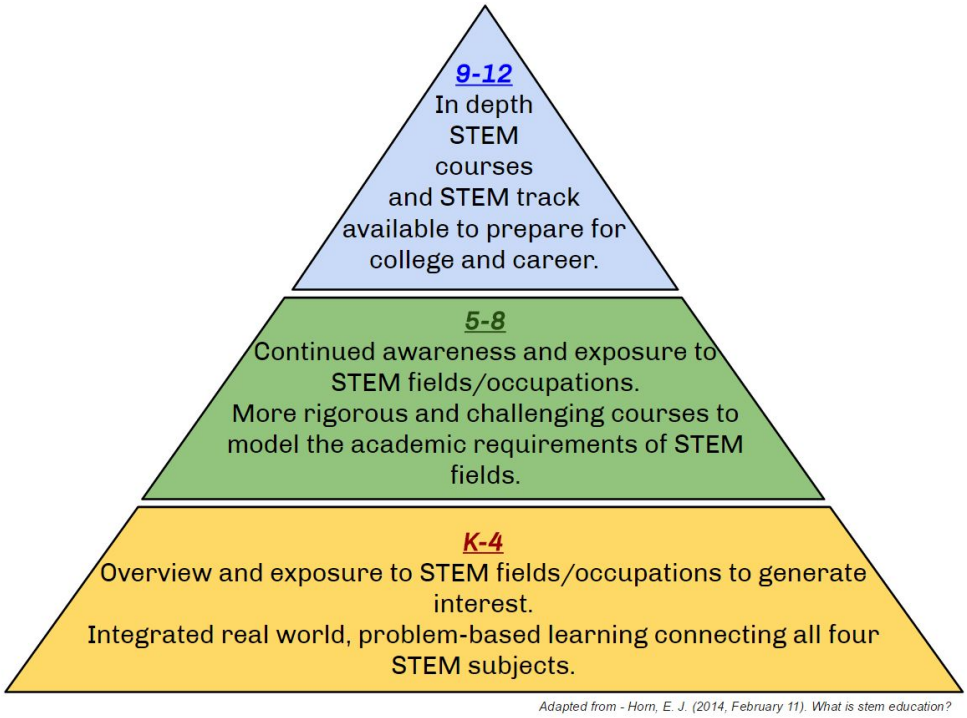

Figure 1: An Overview of the New Providence School District's STEM Initiative

WHERE ARE WE NOW - 2015-16 School Year

The lists below highlight some of the activities that have so far helped shape the direction of the STEM initiative and also include projected ideas for the remainder of the school year.

K-4

Fall 2015 and Winter 2016

- Professional Development training with STEM Pilot teacher group that explored the meaning of STEM and the direction of future initiatives.
- Discussion with Technology teachers and Media Center Specialists about STEM potential
- Pilot STEM activities in a select group of K-6 classrooms
- 3-4 grade STEM Club introducing engineering and design activities
- Expanded 'Week of Code'
- Discussions with the AWR and Salt Brook committees leading to STEM presentations at the Science/STEM Fair kick-off events
- Science/STEM Fair development that includes the opportunity for students to complete STEM projects
- Gifted and Talented incorporation of STEM activities

Spring 2016

- ❏ 5-6 STEM clubs introducing engineering activities and competing in Solar Sprints
- ❏ Mobile Maker Carts introduced as part of NPEF grant.
- ❏ Expansion of Solar Sprints design challenge to 5th Grades
- ❏ Maker Week
- ❏ After School 'Design It' program with Play-Well Teknologies

5-8

Fall 2015 and Winter 2016

- ❏ STEM activities incorporated into Science courses
- ❏ STEM Club introducing coding and app design challenges
- ❏ STEM Club TEAMS Challenge
- ❏ Technology and Math Club competitions
- ❏ Examination of Middle School mod structure and discussions on the introduction of coding and design mods
- ❏ Expanded 'Week of Code'
- ❏ Piloting a MARS Mission Robotics extension in 8th grade (NPEF Grant)
- ❏ Science Olympiad competition at the State Level

Spring 2016

- ❏ Expansion of alternative energy activities into Eighth grade science (NPEF Grant)
- ❏ Linde and Bell Labs Career Day presentations
- ❏ School wide STEM Design challenge
- ❏ Linde Cryogenics demonstrations
- ❏ NJ MS STEM League inaugural event
- ❏ Professional Development to emphasize the use of engineering units in new curricula

9-12

Fall 2015 and Winter 2016

- ❏ STEM activities incorporated into Science courses
- ❏ Introduction of five Engineering/STEM courses for 2016-2017 school year
- ❏ STEM Club of 80+ members competing in numerous competitions and field trip to BELL Labs
- ❏ Math Club of 40+ members competing in live matches against other schools
- ❏ Computer Science club of 25+ members competing in computer competitions
- ❏ Host of NJ STEM League Competition and Hydrogen Cell Car competition
- ❏ Students participating in the Bridge Building, App Design, TSA challenges and Waksman Scholars Program
- ❏ Development of partnership with Project Lead the Way (PLTW)

Spring 2016

- ❏ Host of 'Engineering Tomorrow' workshop in May
- ❏ Continuation of TSA challenges, Panasonic Design Challenge and NJ STEM league competitions
- ❏ Presentation at the Waksman Scholars Program and addition of research to NCBI genbank
- ❏ Professional Development for future PLTW courses
- ❏ Attending Penn State for final of the Propose an App Design Challenge
- ❏ Competing in the ASL Computer Science League

WHERE ARE WE GOING?

Ultimately, the STEM Initiative will need to deliver a fully coordinated and integrated K-12 STEM program that includes an integrated coding/programming component and fully integrated Science/STEM units that address real world problems. To achieve this goal, the following ideas will be examined over the upcoming school years.

K-4

- ❏ Revision of K-4 Science curricula to address the new NGSS standards and to introduce STEM and engineering challenges
- ❏ Incorporation of more coding opportunities into the curriculum
- ❏ Professional Development to develop interdisciplinary, real world, problem-solving performance tasks
- ❏ Incorporation of Maker Space and/or expansion of the Maker Cart program
- ❏ Expansion of STEM clubs to one club at each grade level
- ❏ GT program development to include rigorous STEM challenges
- ❏ STEM lab with K-6 STEM teacher for week long STEM exploration at each grade once per marking period and design of school wide STEM challenges
- ❏ Language Arts integration of STEM and Engineering Books (NPEF Grant)

5-8

- ❏ Revision of 5-8 Science courses to address the new NGSS standards and to include STEM and engineering challenges and a rebranding of Science courses into 'Science and Engineering 5', 'Science and Engineering 6' etc.
- ❏ Examination of the Middle School schedule to identify future educational and STEM possibilities
- ❏ Professional Development to promote interdisciplinary integration of real world, problem-solving, performance tasks
- ❏ New CAD/Coding/App Design/Robotics Mods at 7-8
- ❏ Creation of additional Middle School STEM or PLTW mods
- ❏ Evaluate STEM clubs for numbers and possible additional advisors
- ❏ Creation of school wide Design Challenges
- ❏ Examine the possibility of entering the FIRST Lego Leagues or Technical Challenges

9-12

- ❏ Fully co-ordinated and integrated 9-12 STEM program with a Scope and Sequence
- ❏ Integrated series of STEM electives for college and career readiness
- ❏ A designated STEM instructional area including design and engineering workshops
- ❏ Expansion of STEM clubs based on student enrollment and interest in STEM competitions
- ❏ Expansion of the STEM partnership with Fukui High School
- ❏ Development of a portfolio of potential Online courses
- ❏ Professional development to alignment Math, Science and STEM courses
- ❏ Exposure to STEM College and Career possibilities

Industry Partnerships

Linde, Bell Labs and TransOption have indicated a desire to partner with the school district as we expand the STEM initiative.

Linde provided the guest speaker, judges, videographer and funding when NPHS hosted the NJ STEM League competition in October. Cryogenic demonstrations and guest speakers are proposed for later this school year.

Bell Labs provided funding for various STEM related NPEF Grants and access to the Hackathon where New Providence students were able to access the new messaging platform currently in development at Bell Labs. Additional guest speakers and advisors are available as needed by the district.

TransOption has used New Providence to host their Hydrogen Car and Solar Sprints competition for the last few years. This year they provided a guest presenter and activity at the K-6 STEM Professional Development day and will be exploring the possibility og introducing a Balloon Car challenge at each Elementary School this spring.

The school district is looking to expand on these partnerships when appropriate.

Community Partnership

Various members of the New Providence STEM community volunteered this fall to be judges at the NJ STEM League competition. In addition, the Science Fair committees at both elementary schools have been instrumental in shifting the Science Fair towards a more expansive Science and STEM fair. The community also helped generate interest for the PlayWell extracurricular program held at each elementary school. The possibility of introducing additional community based extracurricular programs will be examined. Work on a Community STEM Resource guide that highlights opportunities for teachers to leverage the STEM expertise in the community will commence this spring.

The school district is looking to develop this partnership over the next few years.

Leveraging the iPad

The district continues to leverage the iPads in a number of ways that address the needs of the STEM initiative. Various activities for the Week of Code successfully used the iPads to introduce students at the K-8 grades to the principles of coding. Where time permits, students continue to experiment with coding using the iPads.

The new mod coding course at the Middle School next year will use the iPads and students in the Robotics course can now also use the iPad to program the Lego robotic bricks.

Project Lead The Way (PLTW) course materials, coursework and curriculum will be accessible through the iPad. Additional resources for the AP Principles of Computer Science course will also be accessible through the iPad, including the Harvard University CS50x course.

As the STEM initiative moves forward, more opportunities to leverage the use of the iPad will be investigated.

Continuing this STEM initiative, and examining new ideas as they arise, the New Providence School District will help students develop the 21st Century and innovation skills, and the critical thinking and creative problem solving strategies necessary to prepare them to meet the challenges of a global society.

The following list highlights some of the resources used in creation of this report and the content contained within it.

Stem School Study,
STEM Lesson Essentials
Exemplary STEM Programs
FEDERAL SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) EDUCATION 5-YEAR STRATEGIC PLAN
What Exactly is STEM Education?
NSTA - STEM Classroom
Next Generation Science Standards