HPS Overview

- K-12 Public Charter School Network
- 43 campuses in TX, 25 T-STEM academies
- Special Ed: 5.3%
- LEP/ESL: 19.5%
- Econ. Disadv: 58.9%

Current Enrollment

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary (K-5)</td>
<td>13,817</td>
</tr>
<tr>
<td>Middle (6-8)</td>
<td>8,509</td>
</tr>
<tr>
<td>High (9-12)</td>
<td>5,919</td>
</tr>
<tr>
<td>Total</td>
<td>28,245</td>
</tr>
</tbody>
</table>
Harmony’s Mission

The mission of Harmony Public Schools is to prepare each student for higher education by providing a safe, caring, and collaborative atmosphere featuring a quality, student-centered educational program with a strong emphasis on science, technology, engineering, and math (STEM).

Core Value #5: STEM for All

Every student will graduate with a strong understanding and appreciation of STEM and how it connects to the real world.
STEM Education is a Priority!

Discussion:

• Why should we focus on STEM?
• How is STEM being prioritized in your school/district?
Harmony’s Approach to STEM Education

1- Project Based Learning (PBL)
2- Technology Integration
3- 21st Century Skills & Deeper Learning Competencies
4- Share & Shine Approach
5- STEM Competitions
6- Work Based Learning Experiences
7- Building Partnerships
Project Based Learning (PBL)

Discussion:
• Share examples of PBL at your campus/district.
• What are your challenges with PBL implementation?

8 Essential Components of PBL:
1. Significant content from standards
2. Need to know sparked by an entry event
3. Driving question
4. Student choice and voice
5. 21st century skills - critical thinking, collaboration, communication
6. Inquiry and innovation
7. Feedback and revision
8. Publicly presented product

Adapted from Buck Institute of Education
Technology Integration

Final Products
- Digital Photo Story
- Google Presentation
- WeVideo Presentation
- Google Sites
- Youtube video
- Brochure

Software used for PBL Videos
- iMovie
- Movie Maker
- Photostory
- WeVideo

6-12 Grade 17,000 CHROMEBOOKS
21st Century Skills & Deeper Learning Competencies

- Master core academic content
- Think critically and solve complex problems
- Work collaboratively
- Communicate effectively
- Learn how to learn
- Develop academic mindsets

Discussion: How does your school/district support teachers to promote deeper learning at all levels?
Share & Shine Approach

- Class and School-wide presentations
- Campus-wide STEM Festivals
- Campus/Regional/State Science Fairs
- Presentations to school visitors
- I-SWEEEP Public Day: STEM EXPO
- Digital Storytelling Contest
- PBL Website Contest
- Other Public STEM Events (Energy Day, Sally Ride Science, USASEF)
STEM Competitions

• Science Fair Competitions
• Digital Storytelling Contest
• Bridge Design Contest
• ECYBERMISSION
• Junior Solar Sprint Competition
• Junior Science & Humanities Symposia
• NASA Space Settlement Design Competition
• Team America Rocketry Challenge (TARC)
• Robotics Competitions (FLL, FTC, FRC)
Work Based Learning Experiences

• Project SEED (ACS)
• BioFORCE (Texas A&M)
• Watershed Wonder: Environmental Summer Research (UHD)
• Research & Engineering Apprenticeship Program – REAP (by AEOP)
• Gains in the Education of Math & Science – GEMS (by AEOP)
• Leading Medicine (by Methodist)
• Engineering Camps (UT, BlueStamp, TexPrep)
• PreFreshman Engineering Program (UTSA)
• Interactive Technology Experience Center – ITEC (UTSA)
• Explore Cru Nursing Camp (Mary Hardin-Baylor)
• Aerospace Scholars (NASA)
STEM Partnerships

- Introduction to STEM skills and knowledge
- Examples of real world applications
- Excitement and motivation of STEM
- Dual credit courses
- Virtual courses, distance learning, online resources
- Innovative STEM pathways
- College support services (campus trips, aid opportunities)

- Program Implementation Support, Coaching, etc.
- Curriculum development
- Extra-curricular program development
- Summer Bridge Programs, STEM Leadership Camps
- STEM Competitions
- Internship / Externship opportunities
- Grant opportunities
- Outreach opportunities
Harmony STEM S.O.S.™ Model

Math/Science

Science
ELA

Social Studies
Math

Level I
4 Projects / Year

Level II or III
1 Project / Year
Interdisciplinary Project Examples

English, Social Studies, Math and Technology Connections in Biology

**Math Connection**: Genetics and probability

Social Studies Connection: Demographic research on different ethnic group to find probability of blue eyes.

**ELA Connection**: Expository text on genetics and probability

**ELA Connection**: Narrative Essay about how a person's life changed due to blood pressure
### Wimshurst's Machine

**What is a Wimshurst Machine?**

Also known as the Wimshurst Influence Machine, it is a manually powered device that belongs to a class of electrostatic generators called influence machines. It produces electric charges through mechanical action, or electrostatic induction, depending on the design for final operation.

Recently, the Wimshurst influence machine is an electromotive generator and is used to generate high voltages without significant amounts of work.

**When was it created?**

The Wimshurst Machine was developed between 1850 and 1852 by Irish engineer Lewis Wimshurst. Later machines in this class were developed by Wilhelm Roentgen (1859-1867), August Freiherr (1865), and others.

The older machines were less efficient and exhibited a supercritical tendency to switch their polarity. The Wimshurst did not suffer this defect.

**How does it work?**

As a Wimshurst machine, the two insulated spheres and their metal sections rotate in opposite directions passing the crossed metal plates from one to the other. Arches are created, amplified, and collected by radio tubes. Each plate has a needle, and the sides of each arch is removed. The mechanical forces are maintained until the spheres are separated.

An electric discharge occurring when the glass plates rub against the metal brushes causing static electricity.

**Safety Precautions:**

Static electricity can cause small puffs when it comes in contact with the skin. You should always be aware of where you place your hands when operating the machine.

**Skills Developed**

- Summarize information
- Organize information
- Creativity
- Communication Skills
- Marketing Skills

---

### Chemical Garden 2012

**What is going on?**

The garden is formed because transition metal silicates are insulable in water and are colored. A metal salt forms an insoluble salt in a double decomposition reaction, and the salt is a semipermeable membrane. Overheating increases the pressure within the membrane because the ion strength inside the membrane is higher than sodium silicate. This leaves the membrane, but the metal's cations react with the silicate's anions and form a new solid. This keeps happening over and over till it grows. If the density of the solid inside the membrane is lower than the surrounding solution, it would grow downwards.

**Introduction and Materials**

The chemical garden was first found by Johann Rudolf Glauber in 1669. He originally used mannite chloride crystals into a solution of potassium silicate. It works because adding sodium transition metal salts to an aqueous solution of sodium silicate (the liquid form of glass) when the metal ions react with the sodium silicate to form a thin membrane of insoluble metal silicate (caused by osmosis), which grows to look like a garden.

**How does it work?**

Four water with liquid sodium silicate with ratio of 2.9L to 3.1L to glass and mix them together

Put small amounts of soft crystals wherever you like in the liquid glass to get different colors

- Calcium chloride: white
- Manganese chloride: pale pink
- Nickel chloride: green
- Copper chloride: light blue-green
- Cobalt chloride: dark blue
- Chromium nitrate: dark green
- Iron chloride: brown

Now, wait for the garden to grow!
2015 STEM FESTIVAL PHOTO ALBUMS

2015 STUDENT SHOWCASE
Harmony Science Academy - Houston High
SATURDAY, FEBRUARY 28
10:00am-2:00pm

Festival
3RD ANNUAL HARMONY SCIENCE ACADEMY-LAREDO STEM FESTIVAL
SAT. JANUARY 17
9:00 - 12:00 PM
@ HSA LAREDO

Free Admission! Open to the Public!
All Ages Invited

FEATURING:
SCIENCE DEMONSTRATIONS
PROJECT BASED LEARNING
ROBOTICS
GAMES
INTERNATIONAL FOOD ENTERTAINMENT

Address: 4401 San Francisco Avenue Laredo, TX 78041
Phone: (956) 712-1177 Fax: (956) 712-1188
Website: www.hslaredo.org
El Paso STEM Festival
200 Harmony students showcasing STEM projects for over 2500 visitors from 44 states and 70 nations.

20 Harmony students training 150-200 STEM teachers with application based sample PBL demos.
Digital Storytelling Contest

http://www.distco.org/
• Biology: https://sites.google.com/site/proteinssynthesis/
• Algebra: https://sites.google.com/site/unitdog2014/
• Geometry: https://sites.google.com/site/stringdesigns2014/
• Physics: https://sites.google.com/site/balancingprojects2014/
• Chemistry: https://sites.google.com/site/chromatography2014/home
• Computer Science: https://sites.google.com/site/hsa2013yaseem33/
• Engineering: https://sites.google.com/site/hse2013jaina25/
Classroom Learning Artifacts

• Physics Samples:
  • Sample Photo Album: Impulse Momentum
  • Sample Photo Album: Acceleration

• Chemistry Samples:
  • Thickness of Oil
  • Salt & Iron in Sea Sand
  • Magnesium Oxide
Sample PBL Project - Roller Coaster
## Concepts Covered

<table>
<thead>
<tr>
<th>Activity</th>
<th>Concepts Covered</th>
<th>LEVEL of ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 1 (challenge 1)</td>
<td>Consv. of Energy and Circular Motion - Basic</td>
<td>Pre-AP Physics</td>
</tr>
<tr>
<td>Activity 2 (challenge 2)</td>
<td>Consv of Energy and Circular Dynamics - Advanced</td>
<td>AP Physics B</td>
</tr>
<tr>
<td>Activity 3 (challenge 3)</td>
<td>Rotational Dynamics</td>
<td>AP Physics C</td>
</tr>
</tbody>
</table>

**Students' Website**
Activity 4 (challenge 4)

None of mechanics concepts can be neglected

Engineering (with High Resolution Sensors)
Impact of STEM Education Focus

- Increasing interest on more rigorous STEM courses
- More PLTW & Robotics courses
- Outperforming state in end-of-course exams
- More Students Getting into Advanced Research Summer Programs
- College STEM Matriculation

### HSA-Houston High

<table>
<thead>
<tr>
<th></th>
<th>SY 2010-11</th>
<th>SY 2011-12</th>
<th>SY 2012-13</th>
</tr>
</thead>
<tbody>
<tr>
<td># of AP Courses in STEM</td>
<td>2</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td># of Students</td>
<td>28</td>
<td>85</td>
<td>175</td>
</tr>
</tbody>
</table>

### Summative Assessments:

#### 2014 Biology EOC:
- 95% passing rate in Harmony
- 8 out of 30 campuses had **100%** passing rate
- 28 out of 30 campuses had greater than **91%** passing rate

#### 2013 EOC Physics

<table>
<thead>
<tr>
<th></th>
<th>Met / Satisfactory</th>
<th>Commended / Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>82%</td>
<td>20%</td>
</tr>
<tr>
<td>Harmony</td>
<td>100%</td>
<td>58%</td>
</tr>
</tbody>
</table>
STEM S.O.S. Book coming out in April 2015!

White Papers:
1- Student Voice
2- Teacher Voice

A Practice-based Model of STEM Teaching

STEM Students on the Stage (SOS)

Alpaslan Sahin

SensePublishers
Q & A

• Thank you for attending this session.

• Please contact me for questions, feedback, and comments.
  • byilmaz@harmonytx.org or (713) 343-3333 ext. 2062

For more about Harmony STEM Activities:

Like us on:
www.facebook.com/harmonySTEM
Follow us on:
www.twitter.com/STEMConnect

CENTER OF STEM EDUCATION

http://stem.harmonytx.org/

Resource Web:
http://pbl.harmonytx.org/